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Applicant(s):	Eric P. Krantz et al.	Group No.:	2878
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Title: METHOD AND APPARATUS TO EFFECTIVELY REDUCE A NON-ACTIVE DETECTION GAP OF AN OPTICAL SENSOR

DECLARATION
OF ERIC KRANTZ, DOUGLAS DEANGELIS AND KIRK SIGEL
PURSUANT TO 37 C.F.R. §1.131

We, Eric P. Krantz, Douglas J. DeAngelis and Kirk Sigel hereby declare as follows:

Background

1. We are named inventor in U.S. Patent Application No. 10/690,237 (the '237 Application), filed on October 20, 2003.

2. We currently reside at the following addresses:

A. Eric Krantz resides at 179 Sheffield Rd., Ithaca, NY 14850.

B. Doug DeAngelis resides at 28 Turkey Shore Rd., Ipswich, MA 01938

C. Kirk Sigel resides at 223 Highgate Rd., Ithaca, NY 14850

3. We hold the following degrees:

A. Eric Krantz holds a PhD in Engineering within the Optical Engineering Group from the University of Aberdeen, Scotland, awarded 1999. The title of his thesis was "An Evaluation of Optical Holography Applied to Imaging in situ Plankton." Eric Krantz also holds an SM in Media Arts and Science from the Massachusetts Institute of Technology, awarded 1987. The title of his thesis was "Optics for Holographic Stereogram Systems."

B. Douglas DeAngelis holds an SM in Electrical Engineering andComputer Science from the Massachusetts Institute of Technology, awarded 2006. The title of his thesis was "MPEG Encoding on the Raw Microprocessor." Douglas DeAngelis also holds a BS in Electrical Engineering from the University of Maine, awarded 1988.

C. Kirk Sigel holds an MS in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology, awarded 1993. The title of his thesis was "Semantic File System Browser." Kirk Sigel also holds a BS in Computer Science and Engineering from the Massachusetts Institute of Technology, awarded 1993.

4. Our employment is as follows:

A. Eric Krantz is employed as an Optical Engineering Consultant with Lynx System Developers, Inc. (hereinafter, "Lynx"), which owns all right, title and interest in and to the '237 Application.

B. Douglas DeAngelis is employed as President of Lynx.

C. Kirk Sigel is employed as a Consultant for Lynx and is also the owner of KSX Technologies.

5. We have studied and understood the specification and claims in the '237 Application, filed October 20, 2003. The claims of the '237 Application generally relate to apparatus and methods for reducing a non-active gap of an optical sensor.

6. This Declaration is being presented under 37 C.F.R. §1.131 to show prior invention by virtue of conception and possession of the inventions of the '237 Application prior to the effective filing dates of (a) U.S. Patent Application Publication No. 2004/0178329 to Kare et al. (hereinafter, "Kare", effective filing date March 13, 2003), and (b) U.S. Patent Application Publication No. 2004/0109653 to Kerr et al. (hereinafter, "Kerr", effective filing date December 9, 2002), and continued due diligence from conception to an effective reduction to practice in the effective filing date of the '237 Application.

Exhibits

7. Attached hereto are Exhibits 1-8, providing documentation of conception and possession of the inventions recited in the '237 Application at least as early as February 8, 2001, and diligence from conception to the filing of the '237 Application on October 20, 2003.

Exhibit 1 includes copies of e-mail correspondence between Doug DeAngelis (President of Lynx and a co-inventor of the '237 Application) and Eric Krantz, dated April 21, 2000, April 23, 2000 and February 8, 2001. The April, 2000 e-mails discuss Eric Krantz's consultation on a project regarding RGB (red, green, blue) color smear. In attempting

to solve this problem, it was determined that RGB color smear and other drawbacks of existing optical sensors could be addressed by developing a solution to compensate for the non-active gap of existing optical sensors. Eric Krantz was expressly hired to help solve this problem, namely, to develop a solution to compensate for the non-active gap of an optical sensor, beginning in November of 2000. The e-mail dated February 8, 2001 is Eric Krantz's reply to Doug DeAngelis's inquiry regarding the status of this project. The idea discussed in the Exhibit 1 e-mails developed into the inventions described in the '237 Application. In particular, the February, 2001 e-mail discusses the concept of a faceplate connected to a detector surface via linear fiber optic arrays to mitigate the 112 micron gap of a specific Kodak optical sensor.

Exhibit 2 is a copy of a confidential e-mail and draft application entitled "Fiber optic component to reduce non-active detection gap between linearly arranged optical detection elements", sent from Eric Krantz to patent attorney David J. Rikkers, Esq. on May 25, 2001.

Exhibit 3 includes a copy of an e-mail sent from Eric Krantz to Doug DeAngelis on May 5, 2001, reporting on confidential discussions with Schott Fiber Optics, Inc. (hereinafter, "Schott") regarding manufacture of a tri-linear faceplate (and a preferred embodiment of the '237 Application). Potential manufacture of a tri-linear faceplate described in the '237 Application was discussed under a Nondisclosure Agreement between Schott and Lynx. Exhibit 3 also includes a confidential e-mail and attachment sent from Eric Krantz to Doug DeAngelis, reporting on discussions regarding manufacture of the tri-linear faceplate with Incom, Inc., (hereinafter, "Incom") on June 8, 2001. Potential manufacture was likewise discussed with Incom under a Nondisclosure Agreement between Lynx and Incom. Such agreement is referenced in the e-mail correspondence on page 3 of Exhibit 3.

In late summer of 2001, development and testing of a tri-linear faceplate described in the '237 Application were discussed with Richard Mead, President of Collimated Holes, Inc. (hereinafter, "Collimated Holes"), under a Nondisclosure Agreement between Collimated Holes and Lynx. Exhibit 3 includes a copy of confidential facsimile correspondence, including a draft application, sent from Eric

Krantz to Collimated Holes, Inc. (hereinafter, "Collimated Holes") on August 27, 2001 EDT. Exhibit 3 also includes a copy of confidential, follow-up e-mail correspondence between Richard Mead and Eric Krantz, dated September 24, 2001. After this follow-up, we began a period of strictly confidential development and testing of the inventions described in the May, 2001 draft. This period (hereinafter, the "Testing Period") began in November of 2001 and lasted until February, 2002. After a brief period of evaluation, the Testing Period resumed in May of 2002 (see Exhibit 7) and lasted until the filing of the '237 Application on October 20, 2003.

Specific issues relating to manufacture by Collimated Holes were first proposed in the Exhibit 3 e-mail dated November 21, 2001. A preliminary experiment to determine feasibility was completed and discussed in the Exhibit 3 e-mail dated January 25, 2002. Based on these results, Richard Mead e-mailed a bid on February 6, 2002, which Eric Krantz forwarded to his alternate e-mail address (eman@media.mit.edu) on May 9, 2002 (see Exhibit 3, page 14). Lynx considered the bid and contracted Collimated Holes to build the prototype, shortly after a personal meeting between Eric Krantz and Richard Mead at Collimated Holes offices on May 23, 2002, referenced in the Exhibit 3 e-mail of June 6, 2002.

Exhibit 4 is a copy of a draft patent application entitled "METHOD AND APPARATUS TO EFFECTIVELY REDUCE A NON-ACTIVE DETECTION GAP OF AN OPTICAL SENSOR", e-mailed from David J. Rikkers, Esq. to Eric Krantz on September 9, 2001, for review. Exhibit 4 also includes draft drawings faxed from David J. Rikkers to Eric Krantz on September 9, 2001, for review.

Exhibit 5 is a copy of e-mail correspondence dated October 7, 2001, sent from Doug DeAngelis to Eric Krantz regarding his review of the draft application and drawings of Exhibit 4 and expressing alternate sensor configurations.

Exhibit 6 is a copy of confidential e-mail correspondence from Eric Krantz to David J. Rikkers, Esq., presenting an additional embodiment of the method and apparatus to effectively reduce a non-active detection gap of an optical sensor. Exhibit 6 is dated November 14, 2001.

Exhibit 7 includes a copy of e-mail correspondence between Richard Mead of Collimated Holes

and Eric Krantz on July 22, 2002, regarding prototype manufacture and testing (during the Testing Period referenced in Exhibit 3). The Exhibit 7 e-mail from David J. Rikkers to Eric Krantz on August 14, 2002 refers to the draft '237 Application, which was undergoing review and revision due to the Testing Period referenced with respect to Exhibit 3. The Exhibit 7 e-mail dated August 29, 2002 is a testing progress report from Collimated Holes to Eric Krantz. The Exhibit 7 letter and e-mail correspondence between Lynx's attorneys at Lahive & Cockfield and Eric Krantz, dated September 20, 2002 and September 29, 2002 (respectively) reference the aforementioned draft patent application and testing by Collimated Holes.

The Exhibit 7 e-mail and attachment of October 8, 2002, is another progress report, from Matt Fate of Collimated Holes, providing details of one confidential test (sent in response to Eric Krantz's inquiry of October 3, 2002). As noted with respect to Exhibit 3, the Testing Period spanned November, 2001 to February, 2002 and May, 2002 until the filing of the '237 Application on October 20, 2003.

Exhibit 7 also includes copies of e-mail correspondence between David J. Rikkers, Doug DeAngelis and Eric Krantz, discussing review of the draft '237 Application, prototype manufacture and testing and subsequent updates to the '237 Application. This correspondence spans March 11, 2003 to March 28, 2003. This correspondence also includes a forwarded copy of e-mail correspondence from Doug DeAngelis to Eric Krantz on December 12, 2002, indicating earlier efforts towards reduction to practice.

Copies of e-mail correspondence spanning May 12, 2003 to October 14, 2003 evidences further testing and results by Collimated Holes. See Exhibit 7, pages 12-14.

Exhibit 7 evidences continued testing and updates through the filing of the '237 Application, providing clear evidence of diligent efforts to refine both the invention and draft application.

Exhibit 8 is a copy of e-mail correspondence sent between Doug DeAngelis, David J. Rikkers and Eric Krantz, from April 3, 2003 to September 28, 2003. This correspondence presents additional materials for the draft '237 Application and discusses various revisions of the draft, prior to filing the final '237 Application with the U.S. Patent

Office on October 20, 2003.

Proof of Conception and Possession of Claim 1

8. The invention stated in claim 1 was conceived of at least as early as the time period between December of 2000 and January of 2001. The general subject matter (e.g., optical mitigation of non-active sensor gaps) had been under consideration since initial meetings between Eric Krantz and Kirk Sigel, of Lynx. These initial meetings occurred before the April, 2000 e-mails of Exhibit 1. In a timely manner, the ideas developed into the claim 1 inventions. The attached Exhibits evidence that consideration of the invention in general prior to February 2001. The Exhibits also provide clear and detailed proof of conception and possession of the invention of claim 1 at least as early as May 25, 2001 (the date of the Exhibit 2 draft application).

9. Each element of claim 1 is set forth below in the exact order it appears in the claim. For each element, recollections (as of today) are recited regarding what was understood about the claim 1 invention in May of 2001. Exemplary evidence that corroborates these recollections follows, including the attached Exhibits.

10. Note that claim 1 was amended on January 23, 2006 to clarify that the recited second optical fiber has a first end oriented toward a field of view and located a first distance...from the first end of a first optical fiber and a second end oriented toward a sensor segment of said second linear array of sensor segments and located a second distance, greater than the first distance, from the second end of said first optical fiber. That amendment was made with full support from the specification (see Applicant's Response filed January 23, 2006), and is reflected in the claim as recited below.

11. The statements made below relate to the state of knowledge and information as of May 25, 2001, except as noted otherwise.

12. Claim 1 relates to an optical sensor apparatus for effectively reducing a non-active gap:

An optical sensor apparatus for effectively reducing a non-active gap, comprising:

Statement:

1. The problem confronted (and which Eric Krantz was specifically contracted to aid in solving) was the relatively large gap between red, green and blue (RGB) elements of a tri-linear sensor and the adverse affects on image fidelity when recording dynamic subjects. This gap is non-active; it is a portion of the optical sensor that can not detect a

signal. For example, if a tri-linear sensor were held stationary, each RGB color element would, in essence, record a different picture of the dynamic scene as it passed by. This is because the physical gap between sensor elements results in a spatial and temporal gap in the recording of the scene. Therefore, merely overlaying or combining color pictures, even with time-correction, can give rise to resolution loss because the dynamic scene itself may well have shifted or transformed.

2. First thoughts regarding mitigation of such adverse affects of sensor gaps on image quality included exploring a diffractive (e.g. holographic grating) or refractive (e.g. prism) solution. However, it became evident that, considering the design trade-offs, neither solution was likely to be sufficiently robust in actual field use (due to alignment tolerances) nor easily compatible with a variety of imaging lenses (the so-called "off-the-shelf compatibility"). This understanding led to consideration of a relay image solution – where the focal plane of the optical sensor (or CCD device) is transferred by means of coherent fiber optics to another focal surface. Coherent fiber optic faceplates are well known. In the case of a coherent fiber taper, the image plane can be magnified or minified dependent on orientation. The unique idea evolved that a coherent fiber faceplate could also be specially constructed to form a contiguous array at one end and oriented to the non-contiguous array of the detector at the other end.

Corroboration:

"Method and apparatus are disclosed for combining a fiber optic component with an optical detection component that effectively reduces the non-active detection gap between the linearly arranged elements of the optical detection component taken alone." Exhibit 2 at page 3, lines 6-8. See also draft claim 1, Exhibit 2, page 3 under "Claims(6)".

As further described in Exhibit 2, "This invention reduces the non-active gap between linear element arrays which effectively acts to diminish the time difference between light sensing by separate RGB elements. The image fidelity possible during image capture is therefore significantly improved." Exhibit 2 page 4, third paragraph.

Exhibit 2 is dated more than 21 months prior to the March 13, 2003 effective date of Kare, and more than 18 months prior to the December 9, 2002 effective date of Kerr.

It is believed that Exhibit 2 evidences conception and possession of the invention prior to both the Kare and Kerr effective dates.

Exhibits 3-8 evidence continued and diligent efforts to improve the May, 2001 draft (Exhibit 2) and to reduce the inventions outlined therein to practice. For example, Exhibit 3 shows early contact with Schott in May, 2001 and with Incom in June, 2001 to discuss potential manufacture of the tri-linear faceplate described in the '237 Application. Exhibit 3 also shows early contact with Collimated Holes to begin testing of my ideas. Exhibit 7 references continued testing through the filing of the '237 Application. See Exhibit 7 page 8, first line of the e-mail from David J. Rikkers dated March, 11, 2003.

Further support for conception and possession prior to Kare and Kerr may be found throughout the revised draft application of Exhibit 4. Exhibit 4 precedes the Kare and Kerr effective dates by about 18 and by about 14 months, respectively. For example, claim 1 of Exhibit 4 is directed to "An optical sensor system for effectively reducing a non-active gap". Exhibit 4, page 14, line 3. See also page 3, lines 21-25; page 4, line 5-page 6, line 4, and page 7, lines 12-19 for various descriptions of this system for reducing a non-active gap.

13. Claim 1 first requires:

an optical sensor having a first linear array of sensor segments and a second linear array of sensor segments separated by a first non-active gap having a first width;

Statement:

1. The line of thought in (and prior to) May of 2001 was to reduce the non-active gap of an optical sensor that has an inherent separation between linear sensing elements. One such example is a tri-linear (RGB) CCD detector which incorporates distinct linear color sensor segments, each separated by a specified non-active gap.

Corroboration:

"This invention reduces the non-active gap between linear element arrays". Exhibit 2 page 4, first line of second paragraph under Background of the Invention; see also FIGs. 1 and 2. Exhibit 2 is dated more than 21 months prior to the March 13, 2003 effective date of Kare, and more than 18 months prior to the December 9, 2002 effective date of Kerr. It is believed that Exhibit 2 evidences conception and possession of the

invention of claim 1, prior to both the Kare and Kerr effective dates.

"Three color linear CCD detectors...are constructed with a significant non-active gap between linear red, green and blue element arrays." Exhibit 2, page 4, lines 1-3 under Background of the Invention.

"According to a first embodiment of the invention, an optical sensor system for effectively reducing a non-active gap is provided with a tri-linear optical sensor with a first linear sensor element and a second linear sensor element separated by a first non-active gap with a first width." Exhibit 4 page 3, lines 5-8. Exhibit 4 evidences conception and possession about 18 and about 14 months earlier than Kare and Kerr, respectively.

In addition, claim 1 of Exhibit 4 includes "a tri-linear optical sensor having a first linear sensor element separated by a fist non-active gap having a first width..." Exhibit 4 page 14, lines 4-5.

Exhibits 3-8 evidence diligent reduction to practice.

14. Claim 1 next requires:

a first optical fiber having a first end oriented toward a field of view and a second end oriented toward a sensor segment of said first linear array of sensor segments;

Statement:

1. The thought in (and prior to) May 2001 was to use optical fibers as a means of effectively reducing or eliminating the non-active gap of an optical sensor. For example, one such optical fiber would be oriented at one end toward a field of view and at the other end oriented toward a sensor element (or segment) of a linear array of the sensor. Thus, a discrete segment of the sensor would be preserved in the relay system of an optical fiber. It was believed that this connection of a field of view to a specific segment by means of an optical fiber would enable the imaging integrity of a linear array of sensor elements to be preserved in a relay system by distinct optical fibers.

Corroboration:

"(A) is a discrete optical fiber or bundle contained in a linear array (B)..."(A), (B) and (C) are contiguous at the input of the fiber optic and spaced at t the output a [*sic.*] the location of the CCD sensor to the specifications of a particular CCD sensor," Exhibit 2

page 4, lines 1-10 under *Brief Description of the Drawings;* see also Figures on pages 5 and 6. It is believed that Exhibit 2 evidences conception and possession of the invention of claim 1, and particularly this claim feature, prior to both the Kare and Kerr effective dates (specifically, more than 21 months before Kare and more than 18 months before Kerr).

Exhibit 3, see Figures on pages 5, 8, 9 and 17.

"A first optical fiber is included with a first end oriented toward a field of view and a second end mounted to a first linear sensor of the linear sensor elements." Exhibit 4 page 3, lines 10-11. It is believed believe that Exhibit 4 likewise evidences conception and possession of the invention of claim 1 (particularly, the aforementioned claim feature) prior to both the Kare and Kerr effective dates.

"A first end of a first optical fiber is oriented toward a field of view. A second end of the first optical fiber is mounted to the first linear sensor element." Exhibit 4 page 5, lines 22-23.

"A fiber optic faceplate is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit surface to correspond with the active linear elements of a CCD sensor." Exhibit 2 page 3, third paragraph under "Abstract".

In addition, claim 1 presented in Exhibit 4 recites "a first optical fiber having a first end oriented toward a field of view and a second end oriented mounted to a first linear sensor of said linear sensor elements;" Exhibit 4 page 14, lines 8-9.

15. Claim 1 finally requires:

a second optical fiber having a first end oriented toward said field of view and located a first distance, less than said first width, from said first end of said first optical fiber and a second end oriented toward a sensor segment of said second linear array of sensor segments and located a second distance, greater than said first distance, from said second end of said first optical fiber, thereby enhancing optical congruence of said first linear array and second linear array in relation to each other.

Statement:

1. Thoughts in (and prior to) May 2001 centered around using optical fibers as a means of effectively reducing or eliminating the non-active gap of an optical sensor. For

example, having considered a discrete segment of a sensor retained in a relay system by means of optical fiber and the imaging integrity of a linear array of sensor segments preserved in a relay system by distinct optical fibers, it was believed that optical fibers oriented toward a field of view could thus be made contiguous to reduce or eliminate the non-active gap of the sensor. In one example of a tri-linear CCD, the fiber optic end facing the field of view (input) could therefore be a contiguous grid matched to the more widely spaced active segments of the tri-linear detector (output).

2. By effectively enhancing the optical congruence between arrays (in this example the linear arrays of a tri-linear sensor) through an arrangement that would provide a closer spacing oriented toward the field of view and a wider spacing oriented toward the detector, the spatial and temporal delay between the RGB sensor elements in receiving color information of a dynamic subject would thus be reduced. Image fidelity would therefore be optically improved because the combined color image components would present a closer match to an actual dynamic scene recorded instantaneously.

Corroboration:

"A fiber optic faceplate is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit surface to correspond with the active linear elements of a CCD sensor." Exhibit 2 page 3, third paragraph under "Abstract". It is believed that Exhibit 2 evidences conception and possession of the invention of claim 1 prior to both the Kare and Kerr effective dates.

"A second optical fiber has a first end oriented toward the field of view and is located a first distance, less than the first width, from the first end of the first optical fiber. The second optical fiber also has a second end mounted to a second linear sensor of the linear sensor elements." Exhibit 4 page 3, lines 11-13. Exhibit 4 evidences conception and possession of the claim 1 invention about 18 and about 14 months earlier than Kare and Kerr, respectively.

"A first spacer is mounted between a second end of the first optical fiber and a second end of the second optical fiber to locate the second end of the first optical fiber and the second end of the second optical fiber further apart than the first end of the first optical fiber and the first end of the second optical fiber and to correspond to elements of

an optical sensor." Exhibit 4 page 5, lines 11-15.

" The gap reduction apparatus 100 serves to orient ends of the optical fibers close together at the first fiber optic faceplate 110. Opposite ends of the optical fibers 130 are then arranged on the second fiber optic faceplate 120 so as to correspond with the sensor elements of the optical sensor 200." Exhibit 4 page 8, lines 4-7.

"According to a variation of an embodiment of the invention, the second fiber optic faceplate 120 may be omitted, allowing direct mounting of the optical fibers 130 to the sensor elements 222, 224, 226 of the optical sensor 200." Exhibit 4 page 12, lines 11-13.

Exhibits 3-8 show diligent testing and reduction to practice of the apparatus described in claim 1 of the '237 Application. For example, Exhibit 5 shows that we did not limit ourselves to the tri-linear sensor embodiment described in the Exhibit 2 and 4 drafts, but considered a variety of options such as "three separate linear sensors (plural). alternatively, you could use a single line taken out of three separate matrix sensors. I can even imagine an application in which you entirely change the configuration of the sensors in use." Exhibit 5 page 1, lines 6-9 of the e-mail from Douglas J. DeAngelis. Exhibit 5 pre-dates Kare by almost 18 months and pre-dates Kerr by more than 15 months.

Proof of Conception and Possession of Claim 15

16. The invention stated in claim 15 was conceived at least as early as the time period between late December of 2000 and January of 2001. The general subject matter (e.g., optical mitigation of non-active sensor gaps) had been under consideration since initial meetings with Kirk Sigel of Lynx. These initial meetings occurred before the April, 2000 e-mails of Exhibit 1. In a timely manner, these initial ideas developed into the claim 1 inventions. It is believed that the attached Exhibits evidence consideration of the invention in general prior to February 2001. The Exhibits also provide clear and detailed proof of conception and possession of the invention of claim 15 at least as early as May 25, 2001 (the date of the Exhibit 2 draft application).

17. Each element of claim 15 is set forth below in the exact order it appears in the claim. For each element, recollections (as of today) are recited regarding what was understood about the claim 1 invention in May of 2001. Exemplary evidence that corroborates these recollections follows, including the attached Exhibits.

18. Claim 15 relates to an optical sensor apparatus for effectively reducing a non-active gap.

An optical sensor apparatus for effectively reducing a non-active gap, comprising:

Statement:

1. The problem confronted (and which Eric Krantz was specifically contracted to aid in solving) was the relatively large gap between red, green and blue (RGB) elements of a tri-linear sensor and the adverse affects on image fidelity when recording dynamic subjects. This gap is non-active; it is a portion of the optical sensor that can not detect a signal. For example, if a tri-linear sensor were held stationary, each RGB color element would, in essence, record a different picture of the dynamic scene as it passed by. This is because the physical gap between sensor elements results in a spatial and temporal gap in the recording of the scene. Therefore, merely overlaying or combining color pictures, even with time-correction, can give rise to resolution loss because the dynamic scene itself may well have shifted or transformed.

2. First thoughts regarding mitigation of such adverse affects of sensor gaps on image quality included exploring a diffractive (e.g. holographic grating) or refractive (e.g. prism) solution. However, it became evident that, considering the design trade-offs, neither solution was likely to be sufficiently robust in actual field use (due to alignment tolerances) nor easily compatible with a variety of imaging lenses (the so-called "off-the-shelf compatibility"). This understanding led to consideration of a relay image solution – where the focal plane of the optical sensor (or CCD device) is transferred by means of coherent fiber optics to another focal surface. Coherent fiber optic faceplates are well known. In the case of a coherent fiber taper, the image plane can be magnified or minified dependent on orientation. The unique idea evolved that a coherent fiber faceplate could also be specially constructed to form a contiguous array at one end and oriented to the non-contiguous array of the detector at the other end.

Corroboration:

"Method and apparatus are disclosed for combining a fiber optic component with an optical detection component that effectively reduces the non-active detection gap between the linearly arranged elements of the optical detection component taken alone."

Exhibit 2 at page 3, lines 6-8. See also draft claim 1, Exhibit 2, page 3 under "Claims(6)".

As further described in Exhibit 2, "This invention reduces the non-active gap between linear element arrays which effectively acts to diminish the time difference between light sensing by separate RGB elements. The image fidelity possible during image capture is therefore significantly improved." Exhibit 2 page 4, third paragraph.

Exhibit 2 is dated more than 21 months prior to the March 13, 2003 effective date of Kare, and more than 18 months prior to the December 9, 2002 effective date of Kerr. It is believed that Exhibit 2 evidences conception and possession prior to both the Kare and Kerr effective dates. Exhibits 3-8 evidence continued and diligent efforts to improve the May, 2001 draft (Exhibit 2) and to reduce the inventions outlined therein to practice. For example, Exhibit 3 shows early contact with Schott in May, 2001 and with Incom in June, 2001 to discuss confidential manufacture of a tri-linear faceplate described in the '237 Application, and later contact with Collimated Holes to initiate the Testing Period. Exhibit 7 references continued testing through the filing of the '237 Application. See Exhibit 7 page 4, first line of the e-mail from David J. Rikkers.

Further support for conception and possession of the invention of claim 15 prior to Kare and Kerr may be found throughout the revised draft application of Exhibit 4. Exhibit 4 precedes the Kare and Kerr effective dates by about 18 and by about 14 months, respectively. For example, claim 1 of Exhibit 4 is directed to "An optical sensor system for effectively reducing a non-active gap". Exhibit 4, page 14, line 3. See also page 3, lines 21-25; page 4, line 5- page 6, line 4, and page 7, lines 12-19 for various descriptions of this system for reducing a non-active gap.

19. Claim 15 first requires:

a tri-linear optical sensor having a first linear sensor element and a second linear sensor element separated by a first non-active gap having a first width and a third linear sensor element separated from said second linear sensor element by a second non-active gap having a second width;

Statement:

1. Thoughts in (and prior to) May of 2001 centered around reducing the non-active gap of an optical sensor that has an inherent separation between linear sensing elements.

One such example is a tri-linear (RGB) CCD detector, which incorporates distinct linear color sensor segments, each separated by a specified non-active gap.

Corroboration:

"Three color linear CCD detectors...are constructed with a significant non-active gap between linear red, green and blue element arrays." Exhibit 2, page 4, lines 1-3 under Background of the Invention.

"This invention reduces the non-active gap between linear element arrays". Exhibit 2 page 4, first line of second paragraph under Background of the Invention; see also FIGs. 1 and 2.

"The optical detection of like aspects of colorful dynamic objects, particularly significant, but not limited to using a [*sic.*] CCD sensor...an optical detection component comprised of separated linear photon detection arrays for red, green and blue elements." Exhibit 2 page 3, claim 6. Exhibit 2 is dated more than 21 months prior to the March 13, 2003 effective date of Kare, and more than 18 months prior to the December 9, 2002 effective date of Kerr. It is believed that Exhibit 2 evidences conception and possession of the invention of claim 15 prior to both the Kare and Kerr effective dates.

"According to a first embodiment of the invention, an optical sensor system for effectively reducing a non-active gap is provided with a tri-linear optical sensor with a first linear sensor element and a second linear sensor element separated by a first non-active gap with a first width. A third linear sensor element is also provided, separated from the second linear sensor element by a second non-active gap having a second width." Exhibit 4 page 3, lines 5-10. Exhibit 4 likewise evidences conception and possession of the invention of claim 15, about 18 months earlier than Kare and about 14 months earlier than Kerr.

In addition, claim 1 of Exhibit 4 includes "a tri-linear optical sensor having a first linear sensor element and a second linear sensor element separated by a first non-active gap having a first width and a third linear sensor element separated from said second linear sensor element by a second non-active gap having a second width;" Exhibit 4 page 14, lines 4-5.

Exhibits 3-8 evidence diligent reduction to practice.

20. Claim 15 next requires:

a first optical fiber having a first end oriented toward a field of view and a second end oriented toward a sensor segment of said first linear sensor element;

Statement:

1. Thoughts in (and prior to) May 2001 included using optical fibers as a means of effectively reducing or eliminating the non-active gap of an optical sensor. For example, one such optical fiber would be oriented at one end towards a field of view and at the other end oriented towards a sensor element (or segment) of a linear array of the sensor. Thus, a discrete segment of the sensor would be preserved in the relay system of an optical fiber. It was believed that this connection of a field of view to a specific segment by means of an optical fiber would enable the imaging integrity of a linear array of sensor elements to be preserved in a relay system by distinct optical fibers.

Corroboration:

"(A) is a discrete optical fiber or bundle contained in a linear array (B)..."(A), (B) and (C) are contiguous at the input of the fiber optic and spaced at t the output a [*sic.*] the location of the CCD sensor to the specifications of a particular CCD sensor," Exhibit 2 page 4, lines 1-10 under "Brief Description of the Drawings"; see also Figures on pages 5 and 6. It is believed that Exhibit 2 evidences conception and possession of claim 15 (particularly, the aforementioned claim feature) more than 21 months before the effective date of Kare and more than 18 months before the effective date of Kerr.

At Exhibit 3, see Figures on pages 5, 8, 9 and 17.

"A first optical fiber is included with a first end oriented toward a field of view and a second end mounted to a first linear sensor of the linear sensor elements." Exhibit 4 page 3, lines 10-11. Exhibit 4 is likewise believed to evidence conception and possession of the invention of claim 15 prior to both the Kare and Kerr effective dates.

"A first end of a first optical fiber is oriented toward a field of view. A second end of the first optical fiber is mounted to the first linear sensor element." Exhibit 4 page 5, lines 22-23.

"A fiber optic faceplate is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit

surface to correspond with the active linear elements of a CCD sensor." Exhibit 2 page 3, third paragraph under "Abstract".

In addition, claim 1 presented in Exhibit 4 recites "a first optical fiber having a first end oriented toward a field of view and a second end oriented mounted to a first linear sensor of said linear sensor elements;" Exhibit 4 page 14, lines 8-9.

21. Claim 15 next requires:

a second optical fiber having a first end oriented toward said field of view and located a first distance, less than said first width, from said first end of said first optical fiber and a second end oriented toward a sensor segment of said second linear sensor element and located a second distance, greater than said first distance, from said second end of said first optical fiber;

Statement:

1. The thought in (and prior to) May 2001 was to use optical fibers as a means of effectively reducing or eliminating the non-active gap of an optical sensor. For example, having considered a discrete segment of a sensor retained in a relay system by means of optical fiber and the imaging integrity of a linear array of sensor segments preserved in a relay system by distinct optical fibers, It was believed that optical fibers oriented toward a field of view could thus be made contiguous to reduce or eliminate the non-active gap of the sensor. In one example of a tri-linear CCD, the fiber optic end facing the field of view (input) could therefore be a contiguous grid matched to the more widely spaced active segments of the tri-linear detector (output).

2. By effectively enhancing the optical congruence between arrays (in this example the linear arrays of a tri-linear sensor) through an arrangement that would provide a closer spacing oriented toward the field of view and a wider spacing oriented toward the detector, the spatial and temporal delay between the RGB sensor elements in receiving color information of a dynamic subject would thus be reduced. Image fidelity would therefore be optically improved because the combined color image components would present a closer match to an actual dynamic scene recorded instantaneously.

Corroboration:

"A fiber optic faceplate is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit

surface to correspond with the active linear elements of a CCD sensor." Exhibit 2 page 3, third paragraph under "Abstract". Exhibit 2 is believed to evidence conception and possession of the invention of claim 15 prior to both the Kare and Kerr effective dates.

"A second optical fiber has a first end oriented toward the field of view and is located a first distance, less than the first width, from the first end of the first optical fiber. The second optical fiber also has a second end mounted to a second linear sensor of the linear sensor elements." Exhibit 4 page 3, lines 11-13. Exhibit 4 evidences conception and possession of the invention of claim 15 (particularly, the aforementioned feature) about 18 and about 14 months earlier than Kare and Kerr, respectively.

"A first spacer is mounted between a second end of the first optical fiber and a second end of the second optical fiber to locate the second end of the first optical fiber and the second end of the second optical fiber further apart than the first end of the first optical fiber and the first end of the second optical fiber and to correspond to elements of an optical sensor." Exhibit 4 page 5, lines 11-15.

"The gap reduction apparatus 100 serves to orient ends of the optical fibers close together at the first fiber optic faceplate 110. Opposite ends of the optical fibers 130 are then arranged on the second fiber optic faceplate 120 so as to correspond with the sensor elements of the optical sensor 200." Exhibit 4 page 8, lines 4-7.

"According to a variation of an embodiment of the invention, the second fiber optic faceplate 120 may be omitted, allowing direct mounting of the optical fibers 130 to the sensor elements 222, 224, 226 of the optical sensor 200." Exhibit 4 page 12, lines 11-13.

The above-noted Exhibits are believed to evidence conception and possession of the invention of claim 15 prior to both the Kare and Kerr effective dates. Exhibits 3-8 show diligent testing and reduction to practice of the apparatus described in claim 1 of the '237 Application.

22. Claim 15 finally requires:

a third optical fiber having a first end oriented toward said field of view and located a third distance, less than said second width, from said first end of said second optical fiber and a second end oriented toward a sensor segment of said third linear sensor element and located a fourth distance,

greater than said third distance, from said second end of said second optical fiber.

Statement:

1. Thoughts in (and prior to) May of 2001 centered on using an arrangement of optical fibers oriented toward a field of view at one end and at the other end oriented toward the sensor elements (or segments) of more widely spaced linear arrays of one or more optical sensors. This arrangement would effectively reduce the non-active gap between linear arrays of sensor elements by means of an optical relay system whereby the spacing oriented toward the field of view was made narrower than the spacing between elements at the sensor arrays.

2. This reduction of the non-active gap between elements of the sensor arrays would therefore enhance optical congruence by reducing the spatial and temporal delay in the recording of, for example, the RGB image components of a dynamic subject. At least three distinct optical fibers would therefore be necessary to correlate to their respective sensor elements of RGB linear arrays. These three fibers could be used to distribute a more closely spaced or contiguous field of view to the more widely spaced RGB sensor elements of an optical sensor.

3. The image fidelity recorded by one or more optical sensors would therefore be improved because the combined image components (for example, RGB components), would present a closer match to the actual dynamic scene instantaneously.

Corroboration:

"A method of effectively decreasing the non-active detection gap between linearly arranged elements of a [sic.] optical detection component by the following means: (a) combining a fiber optic faceplate which is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit surface to correspond with the active linear elements of the optical detection component." Exhibit 2 page 3, draft claim 1.

Exhibit 4, Claim 1 also recites an optical sensor system for effectively reducing a non-active gap, including" a third optical fiber having a first end oriented toward said field of view and located a third distance, less than said second width, from said first end of said second optical fiber and a second end oriented toward a sensor segment of said

third linear sensor element." Exhibit 4 page 14, lines 13-16.

Exhibit 4 Claim 11 includes "a third optical fiber of said plurality of optical fibers having a first end mounted to said first fiber optic faceplate a distance from said first end of said second optical fiber less than said non-active gap and a second end mounted to said second fiber optic faceplate such that said second end of said third optical fiber is located to align with a third linear array of a multiple-linear array image sensor." Exhibit 4 page 16, lines 14-19.

Exhibit 4 Claim 17 includes "a third optical fiber having a first end oriented toward said field of view and a second end located such that said second end of said third optical fiber and said second end of said second optical fiber are further apart than said first end of said third optical fiber and said first end of said second optical fiber and to correspond to elements of an optical sensor; wherein said optical sensor is a tri-linear optical sensor."

Exhibit 4 claim 19 includes "locating a first end of a third optical fiber a third distance, less than said second width, from said first end of said second optical fiber and oriented toward said field of view;" Exhibit 4 page 18, lines 23-25.

See also FIGs. 3A-6, Exhibit 4 pages 26-29.

See also FIG. 3(b), Exhibit 3 pages 5 and 8.

The above-noted Exhibits are believed to evidence conception and possession of the invention recited in claim 15, prior to both the Kare and Kerr effective dates. Exhibits 3-8 show diligent testing and reduction to practice of the apparatus described in claim 1 of the '237 Application.

23. From mid August, 2003 to late September, 2003, materials were prepared for filing of a patent application for the method and apparatus to effectively reduce a non-active detection gap of an optical sensor. That patent application was filed on October 20, 2003 as the '237 Application.

24. The method and apparatus to effectively reduce a non-active detection gap of an optical sensor were conceived and a constructive reduction to practice thereof diligently pursued, entirely within the United States or a NAFTA or WTO member nation.

25. We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief

are true and that all statements made on information and belief are believed to be true; and further that the statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the Application or any patent issued thereon.

Respectfully submitted,

9/18/2006
Date

Eric P. Krantz

9/19/2006
Date

Douglas J. DeAngelis

9/18/2006
Date

Kirk Sigel

ddean@finishlynx.co, 06:24 PM 4/21/00 , CV attached

To: ddean@finishlynx.com
From: Eric P Krantz <eman@media.mit.edu>
Subject: CV attached
Cc: kmsigel@finishlynx.com
Bcc:
Attached: C:\Eric's Documents\Resume\EPK resume1.doc;

Doug,

Attached is a copy of my CV that I gave Kirk. As we discussed,
I agree to prepare a initial assessment of correcting your RGB smear problem by optical means (with emphasis on diffractive optics) at a nominal cost of $250. If we proceed further in mutual confidence then this fee will be waived.
I also agree to sign a standard NDA.

If you have any questions, please don't hesitate to contact me.

Eric

Eric P. Krantz, PhD
eman@media.mit.edu
Tel. (607) 273-2446

EXHIBIT 1

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Douglas J. DeAngeli, 10:19 PM 4/23/00 , Re: CV attached

Received: by mail.a-znet.com (mbox krantz)
(with Cubic Circle's cucipop (v1.31 1998/05/13) Mon Apr 24 08:45:59 2000)
X-From_: ddean@finishlynx.com Sun Apr 23 22:21:57 2000
Return-Path: <ddean@finishlynx.com>
Received: from ns1.a-znet.com (ns1.a-znet.com [209.177.29.3])
by mail.a-znet.com (8.9.3/8.9.3) with ESMTP id WAA06168
for <krantz@mail.a-znet.com>; Sun, 23 Apr 2000 22:21:57 -0400
Received: from ml.media.mit.edu (ml.media.mit.edu [18.85.13.107])
by ns1.a-znet.com (8.9.3/8.9.3) with ESMTP id WAA93662
for <krantz@a-znet.com>; Sun, 23 Apr 2000 22:21:55 -0400 (EDT)
(envelope-from ddean@finishlynx.com)
Received: from aleve.media.mit.edu (aleve.media.mit.edu [18.85.2.171])
by ml.media.mit.edu (8.8.8/8.8.4) with ESMTP
id WAA21952 for <eman@ml.media.mit.edu>; Sun, 23 Apr 2000 22:21:33 -0400 (EDT)
Received: from finishlynx.com (www.finishlynx.com [204.57.46.130])
by aleve.media.mit.edu (8.9.3/8.9.3/+ALEVE) with ESMTP id WAA00496
for <eman@media.mit.edu>; Sun, 23 Apr 2000 22:21:29 -0400 (EDT)
Received: from finishlynx.com [24.218.235.207] by finishlynx.com with ESMTP
(SMTPD32-5.05) id A0A39190088; Sun, 23 Apr 2000 22:25:39 -0400
Message-ID: <3903AF40.AF8EE182@finishlynx.com>
Date: Sun, 23 Apr 2000 22:19:44 -0400
From: "Douglas J. DeAngelis" <ddean@finishlynx.com>
Organization: Lynx System Developers, Inc.
X-Mailer: Mozilla 4.7 [en] (Win95; I)
X-Accept-Language: en
MIME-Version: 1.0
To: Eric P Krantz <eman@media.mit.edu>
Subject: Re: CV attached
References: <3.0.6.32.20000421182406.007ac910@mail.a-znet.com>
Content-Type: multipart/mixed;
boundary="----------70035737DEF22167DDB56CE9"

Attached is an NDA and a short letter that I wrote. The letter is a bit stiff and mostly off the top of my head with a few things pulled from other consulting agreements we have had in the past; I don't pretend to be a lawyer, so please complain if anything looks weird. If everything is OK just print, sign and drop them in the mail. If you need any other info on the project just let me know. I am excited about having someone devoted to thinking about this - it has been very difficult to get anyone fully involved in thinking about it!

Other important things to consider in evaluating a solution to our problem:

1) It is very important that we be able to use standard, off the shelf lenses of all f-stops (i.e., down to f/1.2).
2) It is our goal that when using 35mm lenses, there be a way to insert a reflex mirror in the optical path *before* any correction which would a user to view through the lens for purposes of aligning the camera.

Have fun!

-doug
--

Douglas J. DeAngelis Lynx System Developers, Inc.
ddean@finishlynx.com 175-N New Boston Street
781-935-6959 781-938-0580 fax Woburn, MA 01801
800-989-LYNX http://www.finishlynx.com

Attachment Converted: "c:\eudora\attach\Nda.doc"

Attachment Converted: "c:\eudora\attach\letter.doc"

EXHIBIT 1

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Received: by mail.a-znet.com (mbox krantz)
(with Cubic Circle's cucipop (v1.31 1998/05/13) Thu Feb 8 16:00:12 2001)
X-From_: epkrantz@finishlynx.com Thu Feb 8 15:59:33 2001
Return-Path: <epkrantz@finishlynx.com>
Received: from ns1.a-znet.com (ns1.a-znet.com [209.177.29.3])
by mail.a-znet.com (8.9.3/8.9.3) with ESMTP id PAA04820
for <krantz@mail.a-znet.com>; Thu, 8 Feb 2001 15:59:33 -0500
Received: from finishlynx.com (www.finishlynx.com [204.57.46.130])
by ns1.a-znet.com (8.11.1/8.11.1) with ESMTP id f18KxW322322
for <krantz@a-znet.com>; Thu, 8 Feb 2001 15:59:32 -0500 (EST)
(envelope-from epkrantz@finishlynx.com)
Date: Thu, 8 Feb 2001 15:59:23 -0500
Message-Id: <200102081559.AA69665300@finishlynx.com>
Mime-Version: 1.0
Content-Type: text/plain; charset=us-ascii
From: "Eric Krantz" <epkrantz@finishlynx.com>
Reply-To: <epkrantz@finishlynx.com>
To: <ddean@finishlynx.com>
Subject: Re: status
X-Mailer: <IMail v5.07>

>I guess I am going to have to ask for status a little more often.
>Mike is making progress on the Kodak version of the camera and we >really need to start working in the timeline of an optical correction
>solution for the prototype.
>
>-doug

Reasonable, my job to bring status to your attention. I have not yet resolved a prototype solution.

Trade-offs and limitations between critical issues such as image quality, full-resolution use of CCD for F-mount, alignment, efficient use of light, field operating conditions, off-the-shelf lens compatibility, and cost, along with the less critical (but contractual) issue of C- mount compatibility exist for refractive (dispersion wedge), reflective (Innovations in Optics dichroic mirror) and diffractive (grating) elements.

These issues have recently led me towards a relay image optical system at the CCD focal plane, rather than a direct optical path solution (between lens and CCD). One clear advantage is that the Lynx camera housing could be more easily "built-out" rather than having the optical solution "built-in" to the small space of an F-mount and the miniscule space of a C-mount.

In one configuration, a 6-14 micron element coherent fiber optic faceplate would be located at the present CCD focal plane and coupled by adjacent linear fiber arrays to the detector surface. The time advance/lag could thus be made small relative to the enormous 112 micron spacing of the Kodak chip. Moreover, it may be easier and cheaper to "plug and play" various chips with fiber optics. Also nice to piggyback on a big industry where close-out bargains may potentially be found (rather than to create a new technology like dichroic mirror epoxy technique).

Hope this brief suffices for now, I plan to get a more detailed report to you Tuesday.

Eric

To: djr@lahcoc.com
From: Eric P Krantz <epkrantz@finishlynx.com>
Subject: Fiber optic patent draft
Cc: ddean@finishlynx.com, epkrantz@finishlynx.com
Bcc:
Attached: C:\At Lynx\Fiber Patents\Fiber Optic Linear Array.doc; C:\At Lynx\Fiber Patents\Fig1.doc; C:\At Lynx\Fiber Patents\fig2.doc;

I wanted to get this to you as dated email before meeting with a potential manufacturer
later in the day.

3 attachments in ms word enclosed.

-Eric

EXHIBIT 2
to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel
1 of 6

Received: from xenia.media.mit.edu [18.85.3.135] by finishlynx.com with ESMTP
(SMTPD32-5.05) id ADAD90B0492; Fri, 25 May 2001 08:27:09 -0500
Received: by xenia.media.mit.edu id JAA244918; Fri, 25 May 2001 09:26:15 -0400 (EDT)
Message-Id: <3.0.6.32.20010525092519.007b97f0@finishlynx.com>
X-Sender: epkrantz@finishlynx.com
X-Mailer: QUALCOMM Windows Eudora Light Version 3.0.6 (32)
Date: Fri, 25 May 2001 09:25:19 -0400
To: djr@lahcoc.com
From: Eric P Krantz <epkrantz@finishlynx.com>
Subject: Fiber optic patent draft
Cc: ddean@finishlynx.com, epkrantz@finishlynx.com
Mime-Version: 1.0
Content-Type: multipart/mixed; boundary="==========_990811519==_"
X-RCPT-TO: <epkrantz@finishlynx.com>
X-UIDL: 274489185
Status: U

I wanted to get this to you as dated email before meeting with a potential
manufacturer
later in the day.

3 attachments in ms word enclosed.

-Eric
Attachment Converted: "c:\eudora\attach\Fiber Optic Linear Array.doc"

Attachment Converted: "c:\eudora\attach\Fig1.doc"

Attachment Converted: "c:\eudora\attach\fig2.doc"

==========
Eric P. Krantz Lynx System Developers, Inc.
epkrantz@finishlynx.com 175-N New Boston Street
781-935-6959 extension 48 Woburn, MA 01801
781-938-0580 fax
800-989-LYNX http://www.finishlynx.com
==========

EXHIBIT 2
to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Fiber optic component to reduce non-active detection gap between linearly arranged optical detection elements.

Inventor: Krantz, Eric

Assignee: Lynx System Developers, Inc.

Abstract

Method and apparatus are disclosed for combining a fiber optic component with an optical detection component that effectively reduces the non-active detection gap between the linearly arranged elements of the optical detection component taken alone.

In one preferred embodiment, a fiber optic faceplate is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit surface to correspond with the active linear elements of a CCD sensor.

In another preferred embodiment, a grid of individual optical fibers or fiber bundles are contiguous at the entrance surface and are uniquely aligned to correspond to each active individual element of a linear CCD sensor.

The effect of said embodiments is particularly significant, but not limited, to accurately detecting like aspects of a dynamic colorful object using a tri-linear CCD sensor, a sensor comprised of separated linear photon detection arrays for red, green and blue elements.

Claims (6)

1. A method of effectively decreasing the non-active detection gap between linearly arranged elements of a optical detection component by the following means:

   (a) combining a fiber optic faceplate which is constructed of linear arrays of single optical fibers or fiber optic bundles that are contiguous at the entrance surface and spread at the exit surface to correspond with the active linear elements of the optical detection component; and

   (b) combining a grid of individual optical fibers or fiber bundles that are contiguous at the entrance surface and are uniquely aligned to correspond to each active individual element of the optical detection component.

2. The arrangement of individual optical fibers or fiber optic bundles in a fiber optic faceplate (claim 1.a) whereby one end is comprised of contiguous linear arrays and the other end is comprised of linear arrays separated by some significant distance.

3. The arrangement of a grid of individual optical fibers or fiber optic bundles (claim 1.b) whereby one end is comprised of a contiguous grid and at the other end each optical fiber or fiber optic bundle is uniquely matched in latitudinal and longitudinal order to each corresponding active element of the optical detection component.

4. The combined apparatus of claim 1.a and claim 2.

5. The combined apparatus of claim 1.b and claim 3.

6. The optical detection of like aspects of colorful dynamic objects, particularly significant, but not limited, to using a a tri-linear CCD sensor (claim 4 and 5), an optical detection component comprised of separated linear photon detection arrays for red, green and blue elements.

Field of the Invention

The present invention relates to a fiber optic method for reducing the non-active area between linear red, green and blue (RGB) elements of a tri-linear CCD sensor.

Background of the Invention

Three color linear CCD detectors are used for various and extensive commercial purposes, including color scanners and machine vision. Typically, they are constructed with a significant non-active gap between linear red, green and blue element arrays, which poses no severe difficulty in high fidelity image capture for many applications. These applications are limited to the detection of objects which move at a constant rate along a fixed focal plane and which themselves are not dynamically active (i.e. a sheet of paper along a scanner). Conversely, the object is stationary and the detector moves at a constant rate along a fixed focal plane. The high fidelity is obtained by a method of digitally storing the data of the RGB elements and recombining them to at the precise time of coincidence, as if an aspect of the object had been detected by RGB simultaneously. However, dynamically active objects moving at variable rates along a large depth-of-field pose a severe difficulty in capturing a high fidelity color image.

This invention reduces the non-active gap between linear element arrays which effectively acts to diminish the time difference between light sensing by separate RGB elements. The image fidelity possible during image capture is therefore significantly improved.

Brief Description of the Drawings

Fig. 1 depicts an arrangement (Claim 2) of individual optical fibers or fiber optic bundles in a fiber optic faceplate. (A) is a discrete optical fiber or bundle contained in a linear array (B). (B) is contiguous to a neighboring linear array (C). The dimensions and values assigned to element size and spacing are made to conform to the specifications of a particular CCD sensor, otherwise arbitrarily assigned.

Fig 2. depicts an arrangement (Claim 3) of a grid of individual optical fibers or fiber bundles that are contiguous at the entrance surface and are uniquely aligned to each active of a CCD sensor. (A), (B) and (C) are discrete optical fibers or bundles that are uniquely combined to elements of a CCD sensor. (A), (B) and (C) are contiguous at the input of the fiber optic and spaced at the output a the location of the CCD sensor to the specifications of a particular CCD sensor, otherwise arbitrarily assigned.

References

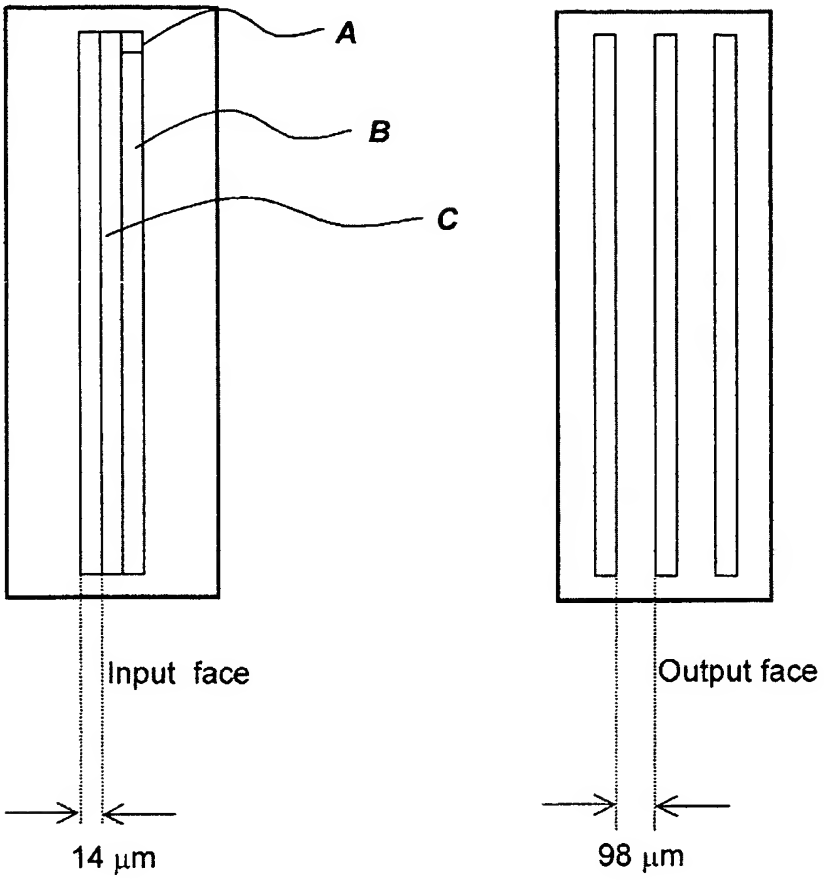
US4904049:High-contrast fiber optic diffusion faceplate with radiused fibers
status: E1 expired

US4573082:Focusable display screen
status: E2 expired

US4871228:Image transfer apparatus utilizing optical fibers

US5729640:Process of acquiring with an X=Y scannable array camera light emanted from a subject

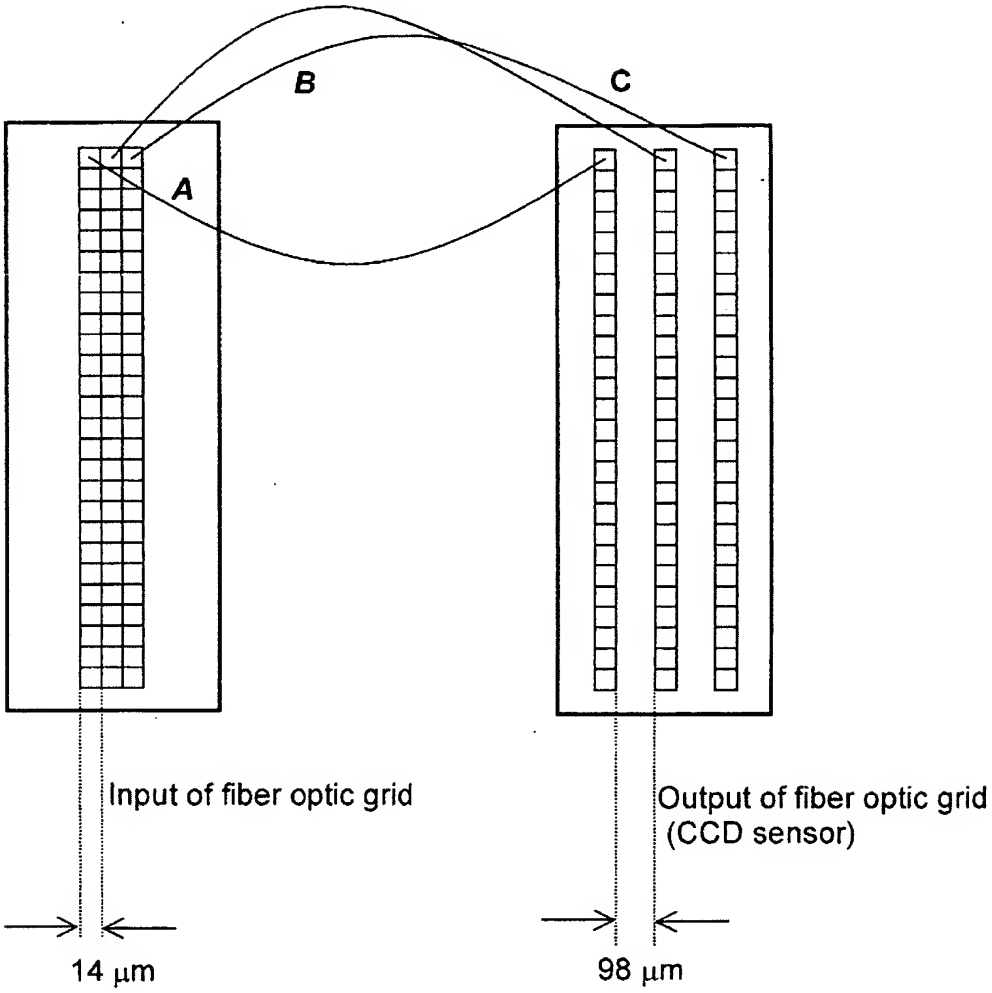
US5061036:Color page scanner using fiber optic bundle and a photosensor array



Fiber optic faceplate package size (bold border) : 31.15 mm X 1.73 mm

EXHIBIT 2
to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Proprietary Property of Lynx System Developers, Inc.



Fiber Optic Grid
Unique Element Addressed
Package size (bold border) : 31.15 mm X 1.73 mm

Proprietary Property of Lynx System Developers, Inc.
175 N New Boston Street
Woburn, MA 01801

ddean@finishlynx.co, 11:37 AM 5/5/01 -, Not Good News

To: ddean@finishlynx.com
From: Eric P Krantz <epkrantz@finishlynx.com>
Subject: Not Good News
Cc:
Bcc: epkrantz@finishlynx.com
Attached:

Doug,
after being led up the garden path, this is more like a welcome to the graveyard.
Peter Huettmann (cc in this email) is the guy with the finger on the button, and I
obviously failed to impress him enough to take on the job in my one phone call to him.

Despite feeling personally pummeled, I still believe the fiber array is the best way to go.
Again, the engineers I met with were not uncomfortable with going for a "best effort" attempt.

I also think that it is worth a try for you to contact Huettmann. In my talk with him, he was especially
interested in the broader applications (e.g. specific applications of machine vision).
No doubt that an alliance with a big name company (i.e. Kodak) would have helped.

Where to take this from here?

-Eric

Peter Huettmann
direct line: 508 765 3369
Business Unit Manager
Flexible Fiber Division

>From: john.oneil@us.schott.com
>X-WM-Posted-At: mail.sfoinc.com; Fri, 4 May 01 14:47:10 -0400
>Subject: fiber array
>To: epkrantz@finishlynx.com
>Cc: senecal@sfoinc.com, peter.huettmann@us.schott.com
>Date: Fri, 4 May 2001 14:49:20 -0400
>X-Priority: 3 (Normal)
>X-MIMETrack: Serialize by Router on SUSXSXS0001/Server/Schott(Release
>5.0.1a (Intl)|17
> August 1999) at 05/04/2001 02:49:20 PM
>MIME-Version: 1.0
>X-RCPT-TO: <epkrantz@finishlynx.com>
>Status: U
>
>Dear Eric,
>
>We spent some time reviewing your requirement against our capability and
>have determined it to be outside our current capability. We have no
>experience in aligning fibers to such tight tolerance and in handling such
>small diameter fibers. Additionally as you are aware, we are so very
>unsure of being able to draw such small fibers and maintain the precision
>required. The area in our factory where any attempt could be made to draw
>such fibers is currently accepting orders for our standard products with 16
>to 20 week delivery commitments. Any engineering effort even if we thought
>it was worth a try would be very far into the future. We certainly
>appreciate you bringing this potential opportunity to us but unfortunately
>must decline.
>
>Best regards,
>
>Schott Fiber Optics, Inc.
>122 Charlton Street
>Southbridge, MA 01550-1960 USA

>
>John O'Neil
>
>508-765-3309 - phone
>508-764-6273 - fax
>oneil@sfoinc.com - e-mail

ddean@finishlynx.co, 05:01 PM 5/5/01 -, alternative companies

To: ddean@finishlynx.com
From: Eric P Krantz <epkrantz@finishlynx.com>
Subject: alternative companies
Cc:
Bcc: epkrantz@finishlynx.com
Attached:

Doug,

Schott may not be the only game in town.
Literally in town is Incom, along with a handful of others around the country.
http://www.incomusa.com/
We are, after all, buyers and not sellers here.

I would like to pursue this route.
Provided, of course, the companies agree to the requisite NDA and
Lynx Rights Ownership forms.

-Eric

Eric P Krantz, 11:29 AM 6/8/01 -, Interesting developments

Received: from top-secret.cable.rcn.com [208.59.178.31] by finishlynx.com
(SMTPD32-5.05) id AFEBCF390280; Fri, 08 Jun 2001 10:31:55 -0500
Message-Id: <3.0.6.32.20010608112942.007c3e10@finishlynx.com>
X-Sender: epkrantz@finishlynx.com
X-Mailer: QUALCOMM Windows Eudora Light Version 3.0.6 (32)
Date: Fri, 08 Jun 2001 11:29:42 -0400
To: ddean@finishlynx.com
From: Eric P Krantz <epkrantz@finishlynx.com>
Subject: Interesting developments
Cc: epkrantz@finishlynx.com
Mime-Version: 1.0
Content-Type: multipart/mixed; boundary="=====_992028582==_"
X-RCPT-TO: <epkrantz@finishlynx.com>
X-UIDL: 274489198
Status: U

Doug,

See attached fig. 5 for a graphic description of the preferred approach to making the fiber optic array a viable (and perhaps even broadly licensed) reality.

Incom, Inc. can provide a custom fiber optic block with very precise (+/- 0.5 micron) square element accuracy across RGB arrays at the estimated cost of $5 - $10 per chip component. Each component is "sliced" from an extruded fiber block "loaf".

The beauty of this approach over the Schott proposal of barrel-wound construction is that element structure and accuracy are already "built-in"-- our specs are "extracted" by removing the unwanted elements by chemical etching or laser micro machining. It puts us in the proven technology areas of accurate fused fiber optic manufacture and micro chemical etching and/or laser ablation. We also have the potential to get accurate pixel-to-pixel matching for full chip resolution.

Incom will work with us to determine the optimum active and non-active fiber strands for our purpose; however, they do not have the facilities to provide the precision slicing and etching we need.

Etching/laser drilling; Component block slicing, compression and re-epoxy; Resurfacing/polishing; Anti-reflection coating [if necessary]; Epoxy CCD mounting
will all require external assistance or need to be contracted somewhere else, which I am presently checking out.

-Eric

Attachment Converted: "c:\eudora\attach\Fig51.doc"

==========

Eric P. Krantz
epkrantz@finishlynx.com
781-935-6959 extension 48
781-938-0580 fax
800-989-LYNX

Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801

http://www.finishlynx.com

==========

EXHIBIT 3
to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Proprietary property of
Lynx System Developers, Inc.

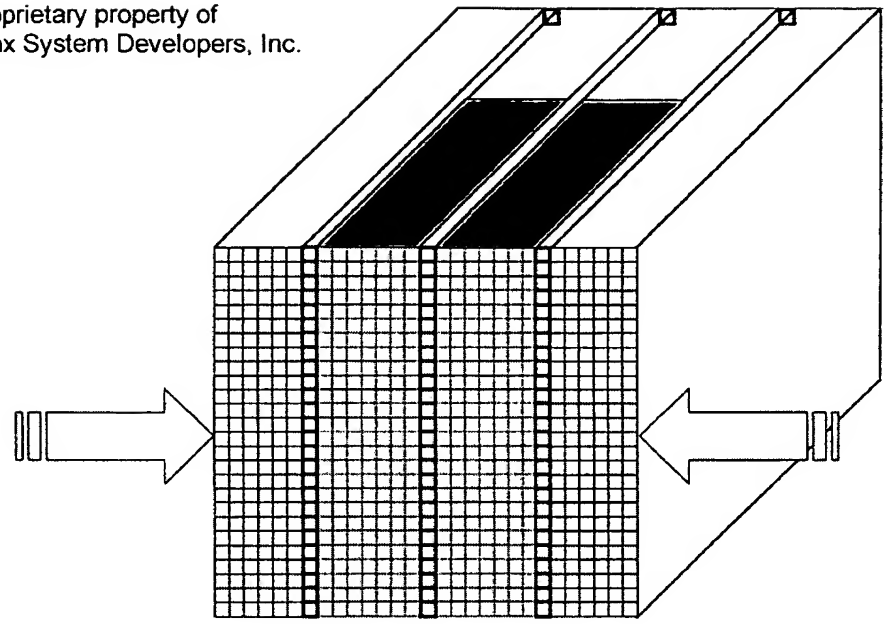


Fig. 3(a): Fused fiber optic block showing precise arrangement of individual fibers. Fibers shown in red are constructed of specialized material designed to be etched. Fibers shown in bold are used as the active elements in the component. After etching, the faceplate block is compressed as indicated by the arrows.

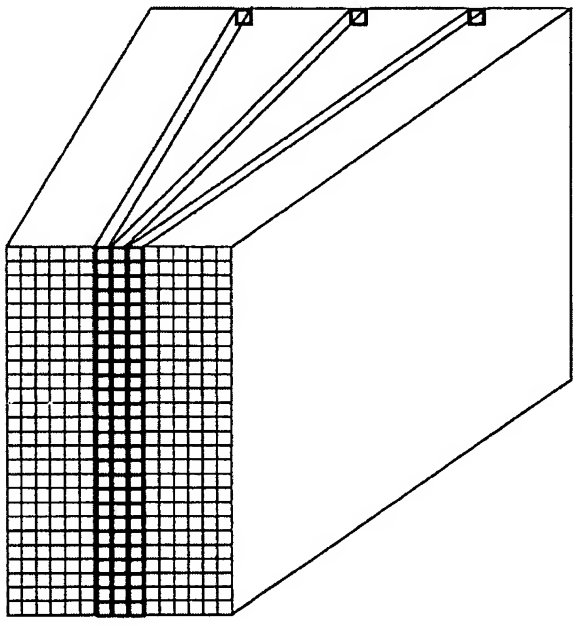


Fig. 3(b): Fused fiber optic block showing precise arrangement of individual fibers after etching and compression.

Sendebericht

28 Aug. 2001 01:01

Nr.	Gegenstelle	Start-Zeit	Übertragungszeit	Modus	Seiten	Ergebnis	Code
01	0014083740670	28 Aug. 0:59	01'37	TX	03	OK	000

BEST AVAILABLE COPY

EXHIBIT 3

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

CONFIDENTIAL

PROPRIETARY PROPERTY OF LYNX SYSTEM DEVELOPERS, INC.
175 N New Boston Street, Woburn, MA 01801

RESENT (MAY HAVE ONLY SENT 2 PAGES)

TO: RICHARD MEAD,
PRESIDENT
COLLIMATED HOLES, INC.
408 374-0670

DATE: AUG. 27, 2001 (EDT)

PAGES (including this one): 3

From: ERIC KRANTZ

Proprietary property of
Lynx System Developers, Inc.

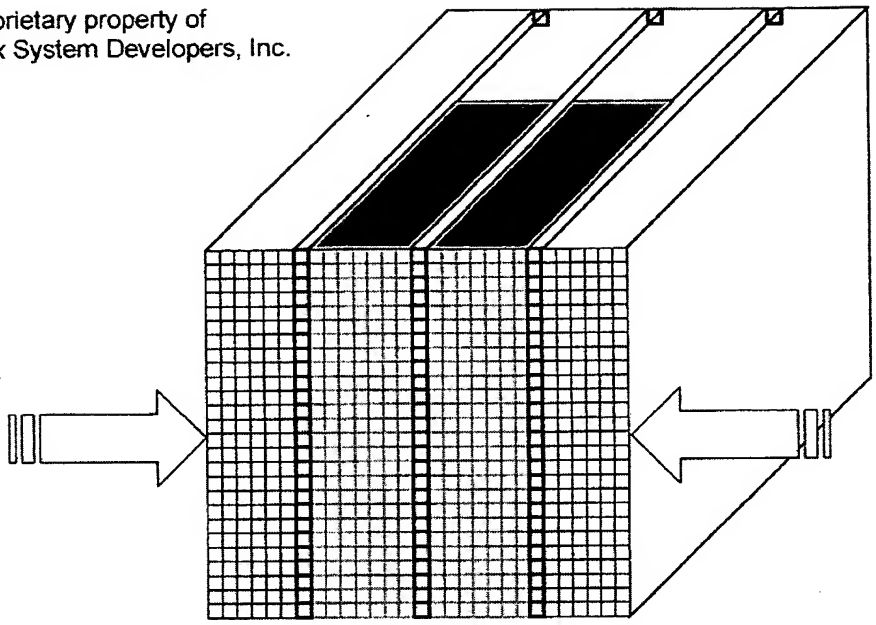


Fig. 3(a): Fused fiber optic block showing precise arrangement of individual fibers. Fibers shown in red are constructed of specialized material designed to be etched. Fibers shown in bold are used as the active elements in the component. After etching, the faceplate block is compressed as indicated by the arrows.

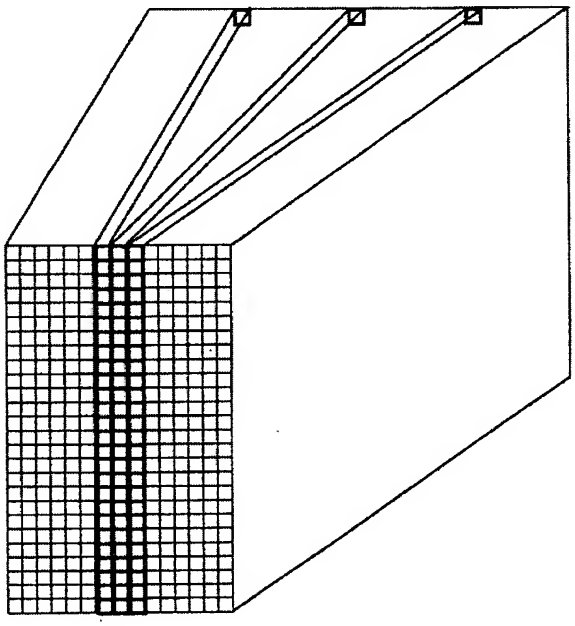
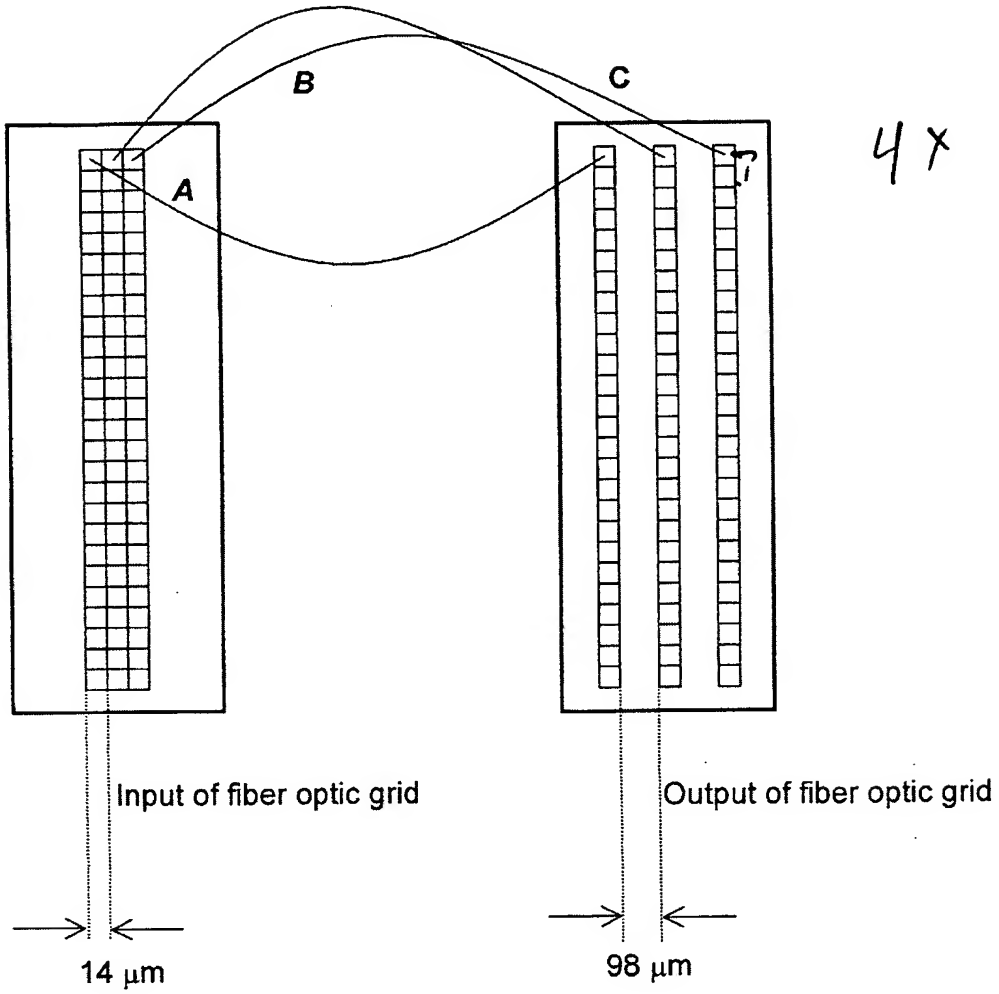


Fig. 3(b): Fused fiber optic block showing precise arrangement of individual fibers after etching and compression.

E



Fiber Optic Grid Unique Element Addressed Package size (bold border) : 31.15 mm X 1.73 mm

Collimated Holes, I, 01:02 PM 9/24/01 , Re: linear faceplate

Date: Mon, 24 Sep 2001 13:02:26 -0700
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Re: linear faceplate
To: Eric P Krantz <epkrantz@finishlynx.com>
X-MIMEOLE: Produced By Microsoft MimeOLE V5.00.2919.6600
X-Mailer: Microsoft Outlook Express 5.00.2919.6600
X-MSMail-priority: Normal
X-RCPT-TO: <epkrantz@finishlynx.com>

Eric,

We are still extremely interested in the project and feel that your design has a very good chance of being among the better methods to achieve it.

We have been very busy -- and horribly distracted -- over the past weeks, but look forward to moving this project ahead.

Regards,

Richard W. Mead

----- Original Message -----
From: "Eric P Krantz" <epkrantz@finishlynx.com>
To: <chi_2000@pacbell.net>
Sent: Monday, September 24, 2001 8:50 AM
Subject: linear faceplate

> Richard,
>
> Could you please update me on your position
> in regards to our conversations in August about
> manufacturing a tri-linear fused fiber optic plate.
>
> Best regards,
>
> Eric
>

Collimated Holes, I, 04:52 PM 11/21/01, Re: linear faceplate

Received: from snfc21.pbi.net [206.13.28.240] by finishlynx.com with ESMTP
(SMTPD32-5.05) id ACF8DDB00C0; Wed, 21 Nov 2001 19:55:20 -0500
Received: from netcomputer ([207.214.213.123])
by mta6.snfc21.pbi.net (iPlanet Messaging Server 5.1 (built May 7 2001))
with SMTP id <0GN6002ZWFVFW6@mta6.snfc21.pbi.net> for epkrantz@finishlynx.com;
Wed, 21 Nov 2001 16:54:53 -0800 (PST)
Date: Wed, 21 Nov 2001 16:52:18 -0800
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Re: linear faceplate
To: Eric P Krantz <epkrantz@finishlynx.com>
Message-id: <003501c172ef$f05d96a0$7bd5d6cf@netcomputer>
MIME-version: 1.0
X-MIMEOLE: Produced By Microsoft MimeOLE V5.00.2919.6600
X-Mailer: Microsoft Outlook Express 5.00.2919.6600
Content-type: text/plain; charset=iso-8859-1
Content-transfer-encoding: 7bit
X-Priority: 3
X-MSMail-priority: Normal
References: <3.0.6.32.20010924115026.007997a0@finishlynx.com>
<3.0.6.32.20011112160705.007a26e0@xenia.media.mit.edu>
X-RCPT-TO: <epkrantz@finishlynx.com>
X-UIDL: 274489256
Status: U

Eric,

Can you consider a two-part structure, where each half would be 15.5mm tall, instead of one element 31mm tall? I think vertical alignment would be something we could fixture to achieve repeatably.

Regards,
Richard W. Mead

Collimated Holes, I, 02:47 PM 1/25/02 , Re: faceplate proposal

Received: from mta5.snfc21.pbi.net [206.13.28.241] by finishlynx.com with ESMTP
(SMTPD32-5.05) id A2188C60158; Fri, 25 Jan 2002 17:54:16 -0500
Received: from netcomputer ([207.214.212.189])
by mta5.snfc21.pbi.net (iPlanet Messaging Server 5.1 (built May 7 2001))
with SMTP id <0GQI005VMNJZX1@mta5.snfc21.pbi.net> for epkrantz@finishlynx.com;
Fri, 25 Jan 2002 14:52:49 -0800 (PST)
Date: Fri, 25 Jan 2002 14:47:16 -0800
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Re: faceplate proposal
To: Eric P Krantz <epkrantz@finishlynx.com>
Message-id: <000b01c1a5f2$3e4baca0$bdd4d6cf@netcomputer>
MIME-version: 1.0
X-MIMEOLE: Produced By Microsoft MimeOLE V5.00.2919.6600
X-Mailer: Microsoft Outlook Express 5.00.2919.6600
Content-type: text/plain; charset=iso-8859-1
Content-transfer-encoding: 7bit
X-Priority: 3
X-MSMail-priority: Normal
References: <200201130903.AA21627390@finishlynx.com>
<3.0.6.32.20020125151511.0079f100@finishlynx.com>
X-RCPT-TO: <epkrantz@finishlynx.com>
X-UIDL: 310930641
Status: U

Eric,

Part of our experiment was successful, and part of it pointed us in the right direction (Yes, this is a euphemism for "part of it was a failure"). I will provide you with the details on Monday, and we can discuss the project at that time. After this recent trial, I am reasonably confident that the device can be reduced to production.

Sincerely,

Richard W. Mead, President
Collimated Holes, Inc.
460 Division Street
Campbell, CA 95008
TEL: 408-374-5080 x-211
FAX: 408-374-0670
www.collimatedholes.com

----- Original Message -----
From: "Eric P Krantz" <epkrantz@finishlynx.com>
To: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Sent: Friday, January 25, 2002 12:15 PM
Subject: Re: faceplate proposal

> Richard,
>
> I am looking forward to the results of your preliminary unit.
>
> Taller production units are generally preferable in the sense that they
> would require, as I understand it, less "splicing" together to make up
> the entire lenght of the sensor.
>
> Probably a shorter fiber portion would be better in production
> in the sense of creating a more compact unit after epoxy to the
> chip.
>
> However, the door of experience is open on both these issues,
> and will definitely weigh in terms of cost, quality and durability.
>
> Again, we are particularly poised to pull the trigger on a purchase

> order for a prototype.
>
> Sincerely,
>
> Eric
>
>
> At 04:57 PM 1/14/02 -0800, you wrote:
> >Eric,
> >
> >Thanks for the note.
> >
> >We will be constructing a unit this week for the purpose of assessing the
> >value of all the thinking we have done to date. Traditionally, not all
of
> >our thinking has been of value, but we should have a unit to discuss
> >shortly.
> >
> >The unit will probably be 10mm tall. Can you comment on the problems --
if
> >any -- associated with taller or shorter units for the production unit?
In
> >production, will it matter of the fiber portion is 6mm or 15mm?
> >
> >Sincerely,
> >
> >Richard W. Mead, President
>
> ==========
> Dr. Eric P. Krantz Lynx System Developers, Inc.
> epkrantz@finishlynx.com 175-N New Boston Street
> Home office: (607) 273-2967 Woburn, MA 01801
> 781-935-6959 extension 48
> 781-938-0580 fax
> http://www.finishlynx.com
> ==========
>
>

Eric Paul Krantz, 06:36 PM 5/9/02 +, FWD: custom faceplate and atta

X-Sender: krantz@pop-server.twcny.rr.com
X-Mailer: QUALCOMM Windows Eudora Version 5.1
Date: Thu, 09 May 2002 18:36:16 +0200
To: eman@media.mit.edu
From: Eric Paul Krantz <eman@media.mit.edu>
Subject: FWD: custom faceplate and attachment
X-Virus-Scanned: by AMaViS-perl11-milter (http://amavis.org/)

>Date: Wed, 6 Feb 2002 17:28:19 -0500
>From: "Eric Krantz" <epkrantz@finishlynx.com>
>Reply-To: <epkrantz@finishlynx.com>
>To: <ddean@finishlynx.com>
>CC: <kmsigel@finishlynx.com>
>Subject: FWD: custom faceplate and attachment
>X-Mailer: <IMail v5.07>
>
>
>Doug,
>
>A concrete step towards the solution. Not cheap.
>I have some skeptism on his proposed production methods
>particulary in regards to:
>
>-- accurate "finish line" linearity along the chip length
>-- variations in epoxy thickness of the unit between pixels and columns
>
>Details and strategy to follow, this is the raw proposal as of today.
>
>-Eric
>
>
>---------- Original Message ----------
>From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
>Date: Wed, 06 Feb 2002 09:22:34 -0800
>
>Eric,
>
>We have completed our meetings and discussions relating to the creation of
>tooling to mount the custom faceplate with which we have been
>experimenting over the past several weeks. Although there are residual
>uncertainties, I am willing to provide a fixed price for the creation of
>three prototype windows and the design and implementation of attachment
>tooling, and the attachment of three windows to sensors provided by Lynx.
>
>Item Price
> Del
>
>Three prototype windows $7,850/lot of
>three 4 weeks
>
>Design, build, break-in tooling and attach
> three
> windows $11,300
> 5 weeks
>
>
>For your planning purposes, I currently cannot imagine that the
>production-quantity price of the window and its attachment will be less
>than $100, nor more than $200. So many uncertainties exist at this point,
>including issues of yield, that a reliable estimate is simply not
>currently possible.

Collimated Holes, I, 04:41 PM 6/6/02 -, Re: start project

Received: from mta5.snfc21.pbi.net [206.13.28.241] by finishlynx.com with ESMTP
(SMTPD32-7.10) id A4772910136; Thu, 06 Jun 2002 19:47:03 -0400
Received: from netcomputer ([207.214.212.171])
by mta5.snfc21.pbi.net (iPlanet Messaging Server 5.1 (built May 7 2001))
with SMTP id <0GXB00DYV628Y3@mta5.snfc21.pbi.net> for epkrantz@finishlynx.com;
Thu, 06 Jun 2002 16:46:58 -0700 (PDT)
Date: Thu, 06 Jun 2002 16:41:09 -0700
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Re: start project
To: Eric P Krantz <epkrantz@finishlynx.com>
Message-id: <004401c20db3$a40b3460$abd4d6cf@netcomputer>
MIME-version: 1.0
X-MIMEOLE: Produced By Microsoft MimeOLE V5.00.2919.6600
X-Mailer: Microsoft Outlook Express 5.00.2919.6600
Content-type: text/plain; charset=iso-8859-1
Content-transfer-encoding: 7bit
X-Priority: 3
X-MSMail-priority: Normal
References: <3.0.6.32.20020530130941.007ad200@finishlynx.com>
X-RCPT-TO: <epkrantz@finishlynx.com>
Status: U
X-UIDL: 323325762

Eric,

Below is the text of a FAX I sent this afternoon to your attention and cc to Doug DeAngelis at 781-938-0580. The transmittal contained copies of the relevant email documents, which you already have.

Regards,
Richard W. Mead, President
Collimated Holes, Inc.
460 Division Street
Campbell, CA 95008
TEL: 408-374-5080 x-211
FAX: 408-374-0670
www.collimatedholes.com

"Eric,

The description you provided by email -- attached hereto -- is a good representation of the discussion we had at CHI during your recent visit. At this time I have no substantive changes to propose.

This will confirm our offer to create three prototype custom faceplates for a total of $7,850 and to develop the tooling and techniques to mount these three windows on sensors to be provided by LSDI for a total of $11,300. This offer was transmitted in an email of February 6, 2002, which is attached hereto.

We would appreciate terms of one-half down and one-half Net 30.

Thank you for your consideration.

Sincerely,"

May 30, 2002

Collimated Holes Invoice:

Item	Price	Delivery
Three prototype windows (See attached Figures 1 and 2 and Specifications)	$7,850/lot of three	6 weeks: First two prototypes 8 weeks: Third prototype
Design, build, break-in tooling and attach three windows (See Specifications)	$11,300	6 weeks: First two prototypes 8 weeks: Third prototype
	Total: $19,150	

Payment Schedule:

$9,575 to commence order.
$9,575 due on final delivery of Third attached prototype window.

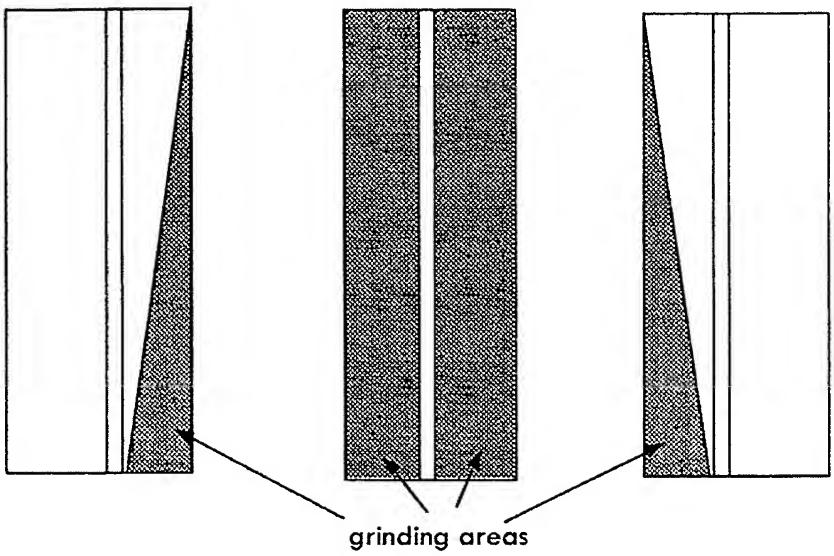


Figure 1. Top view of tri-component prototype solution. Each component is manufactured from a similar block of 5 micron fibers and precision ground. Far left and right components are mirrored.

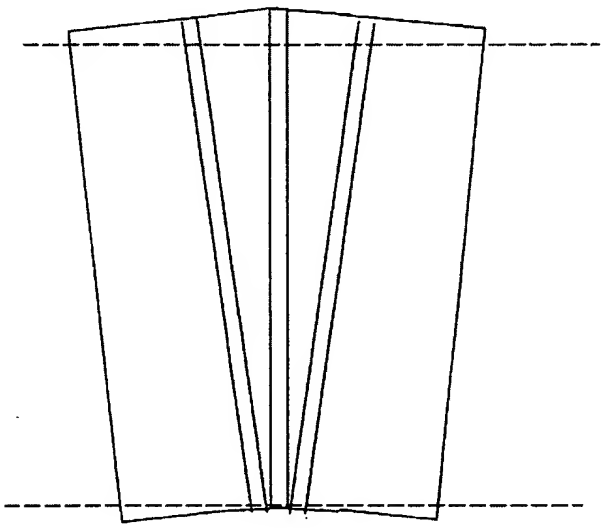


Figure 2. The three components are fused together by epoxy or heat treatment and ground at the planes shown by the dotted lines to conform to the chip specifications.

From: David J. Rikkers
To: Eric P Krantz
Date: 9/28/01 7:14PM
Subject: LSR-013 draft

Draft Patent Application for: METHOD AND APPARATUS TO EFFECTIVELY REDUCE A NON-ACTIVE DETECTION GAP OF AN OPTICAL SENSOR

Eric:

Please read the attached application text and review the figures faxed to you today to verify that this application completely and accurately describes your invention and the best known mode for practicing the invention. I look forward to any comments or questions you may have.

David J. Rikkers, Esq.
Lahive & Cockfield, LLP
28 State Street
Boston, MA 02109
djr@lahive.com
617-994-0788 direct dial
617-227-7400
617-742-4214 fax

CC: Ralph A. Loren

METHOD AND APPARATUS TO EFFECTIVELY REDUCE A NON-ACTIVE DETECTION GAP OF AN OPTICAL SENSOR

Field of the Invention

This invention relates to optical sensors and more particularly relates to the effective reduction of a non-active gap between elements of an optical sensor.

Background of the Invention

Optical sensors are used for a wide variety of imaging purposes. Many optical sensors involve the use of multiple sensor elements, with each of the sensor elements capturing a portion of an image. Manufacturing of optical sensors may involve a non-active gap between these sensor elements. For many applications, the size of such a gap does not create difficulty in the capturing of images. However, in imaging unevenly moving objects, or objects close in color, this non-active gap can be a source of blurring or inconsistent imaging.

Summary of the Invention

The present invention concerns methods of ameliorating the problems caused by non-active gaps. One example of an image sensor having separation between sensor elements, e.g. non-active gaps, is the three-color linear CCD detector that is used for various and extensive commercial purposes, including color scanners and machine vision. Typically, this optical sensor is constructed with significant non-active gaps between the linear red, green and blue element arrays. These non-active gaps pose no severe difficulty in high fidelity image capture for many applications. These applications are limited to the detection of objects which move at a constant rate along a fixed focal

plane and which themselves are not dynamically active, such as a sheet of paper along a scanner, or when the object is stationary and the optical sensor moves at a constant rate along a fixed focal plane.

However, dynamically active objects moving at variable rates pose a severe difficulty in capturing a high fidelity color image, particularly when a large depth-of-field is required. An example of such a situation is a finish line of a race or other competition when observed from the side. In such a case, a difficulty caused by the separation of sensor elements results in an inaccurate representation of the events at the finish line. Results may be influenced by the color of a jersey worn by a competitor, as the first optical sensor encountered by the competitors detects one color, while other colors are not detected until an optical sensor encountered later.

Even if all jerseys are the same color, the image produced by a multi-linear optical detector viewing a variable rate object crossing the detector can be distorted by separation between the sensor elements, as the colors that make up the image are delayed differently in relation to each other. This can cause an image to be blurred unevenly, potentially resulting in difficulty in who won a race, or even in determining distinguishing characteristics of competitors from the captured image.

The present invention overcomes difficulties of the prior art by the use of optical fibers oriented to obtain visual images from a field of view at one location and distribute components of the optical images to more widely-spaced sensor elements of an optical sensor. In the above example, this invention effective reduces the non-active gap between linear element arrays which reduces the time delays between separate sensor

element signals, such as red, green and blue image signals, when sensing a moving object. The image fidelity possible during image capture is therefore significantly improved.

According to a first embodiment of the invention, an optical sensor system for effectively reducing a non-active gap is provided with a tri-linear optical sensor with a first linear sensor element and a second linear sensor element separated by a first non-active gap with a first width. A third linear sensor element is also provided, separated from the second linear sensor element by a second non-active gap having a second width. A first optical fiber is included with a first end oriented toward a field of view and a second end mounted to a first linear sensor of the linear sensor elements. A second optical fiber has a first end oriented toward the field of view and is located a first distance, less than the first width, from the first end of the first optical fiber. The second optical fiber also has a second end mounted to a second linear sensor of the linear sensor elements. A third optical fiber has a first end oriented toward the field of view and located a third distance, less than the second width, from the first end of the second optical fiber. A second end of the third optical fiber is mounted to a third linear sensor of the linear sensor elements.

According to another embodiment of the invention, an apparatus for effectively reducing a non-active gap of an optical sensor is provided with a first fiber optic faceplate configured to accommodate a plurality of optical fibers. A second fiber optic faceplate is also configured to accommodate the plurality of optical fibers. A first optical fiber of the plurality of optical fibers has a first end mounted to the first fiber optic faceplate and a second end mounted to the second fiber optic faceplate. A second

optical fiber of the plurality of optical fibers has a first end mounted to the first fiber optic faceplate a first distance, less than the non-active gap, from the first optical fiber and the second optical fiber having a second end mounted to the second fiber optic faceplate such that the second end of the first optical fiber and the second end of the second optical fiber are spaced to align with a first linear array and a second linear array, respectively, of a multiple-linear array image sensor.

A further embodiment of the invention provides an apparatus for effectively reducing a non-active gap of an optical sensor. A first optical fiber and a second optical fiber are mounted to each other such that a first end of the first optical fiber and a first end of the second optical fiber are oriented toward a field of view. A first spacer is mounted between a second end of the first optical fiber and a second end of the second optical fiber to locate the second end of the first optical fiber and the second end of the second optical fiber further apart than the first end of the first optical fiber and the first end of the second optical fiber and to correspond to elements of an optical sensor.

Another embodiment of the invention provides a method of effectively reducing a non-active gap of an optical sensor, including the steps of providing a tri-linear optical sensor. The sensor has a first linear sensor element and a second linear sensor element separated by a first non-active gap of a first width and a third linear sensor element separated from the second linear sensor element by a second non-active gap of a second width. A first end of a first optical fiber is oriented toward a field of view. A second end of the first optical fiber is mounted to the first linear sensor element. A first end of a second optical fiber is located a first distance, less than the first width, from the first end of the first optical fiber and oriented toward the field of view. A second end of the

second optical fiber is mounted to the second linear sensor element. A first end of a third optical fiber is located a third distance, less than the second width, from the first end of the second optical fiber and oriented toward the field of view. A second end of the third optical fiber is mounted to the third linear sensor element.

Brief Description of the Drawings

The foregoing and other objects, features and advantages of the invention will be apparent from the following description and apparent from the accompanying drawings, in which like reference characters refer to the same parts throughout the different views. The drawings illustrate principles of the invention and, although not to scale, show relative dimensions.

Figure 1 illustrates a top view of an optical sensor system oriented toward a field of view;

Figure 2 illustrates a side view of the optical sensor system of Figure1;

Figures 3A & 3B illustrate first and second fiber optic faceplates of a gap reduction apparatus;

Figure 4 illustrates sample pixel configurations of the first and second fiber optic faceplates of Figures 3A and 3B;

Figure 5 illustrates an optical sensor; and

Figure 6 illustrates an optical sensor system according to an alternative environment of the present invention.

Detailed Description of the Invention

The present invention overcomes difficulties of the prior art by the use of optical fibers oriented to obtain visual images from a field of view at one location and distribute components of the optical images to more widely-spaced sensor elements of an optical sensor.

As shown in Figures 1 and 2, a gap reduction apparatus 100 to be used with an optical sensor 200 in order to obtain an optical image from a field of view 10. The gap reduction apparatus 100 and the optical sensor 200 form an optical sensor system 300. In variations of the invention, lenses or other optical elements may optionally be incorporated into the optical sensor system 300.

As used herein, the term "non-active gap" relates to the separation between sensor elements of an optical sensor. Each sensor element of the optical sensor is active in that it is able to optically detect light at the location of the optical sensor. The space between each sensor element is typically caused by manufacturing limitations. This space is non-active in that the optical sensor is not able to detect light at locations between the sensor elements. The present invention serves to minimize the detrimental effects of this non-active gap, while not physically altering the dimensions of the non-active gap. The invention is suitable for use with a wide range of non-active gaps.

According to an embodiment of the invention, the gap reduction apparatus 100 is formed of a first fiber optic faceplate 110 and a second fiber optic faceplate 120. The first fiber optic faceplate 110 and a second fiber optic faceplate 120 are optically coupled by optical fibers 130. Preferably, the optical fibers 130 will be oriented to

correspond with sensor elements of an optical sensor 200. The present invention is suitable for use with a wide variety of optical sensors 200.

The gap reduction apparatus 100 serves to orient ends of the optical fibers close together at the first fiber optic faceplate 110. Opposite ends of the optical fibers 130 are then arranged on the second fiber optic faceplate 120 so as to correspond with the sensor elements of the optical sensor 200.

Figures 3A, 3B, 4 and 5 illustrate the gap reduction apparatus 100 and optical sensor 200 according to an illustrated embodiment of the invention. As shown in Figure 3A, the first fiber optic faceplate 110 is shown having a first column 112, a second column 114 and a third column 116. Ideally, each of these columns will be divided into segments, such as pixels, illustratively shown in the third column 116 by pixel 118. As used herein "segment" relates to any portion, such as a pixel or other identifiable sub-unit, of the columns or the sensor elements of the optical sensor 200.

Preferably, the first, second and third columns 112, 114, 116 are located contiguous to each other, thereby minimizing any separation between the first, second and third columns, 112, 114 and 116. According to one embodiment of the present invention, distance A, as shown in Figures 3A, 3B and 4, is 14 microns and the overall dimensions of the first fiber optic faceplate 110 are approximately 3 centimeters by 2 centimeters. However, the invention is suitable to a wide range of dimensions and sizes of optical fibers 130. Instrumental to the invention is the greater separation of the optical fibers 130 on the second fiber optic faceplate 120 when compared to the first fiber optic faceplate 110. Therefore, the distance between each of the first, second and

third columns 112, 114, 116 is smaller than the non-active gap of an optical sensor interfacing with the second fiber optic faceplate 120. It is understood that although the pixels and optical fibers are illustrated herein as square, optical fibers may also be, and typically are, of round or rounded shape.

The second fiber optic faceplate 120 is illustrated in Figure 3B. Similar to the first fiber optic faceplate 110, the second fiber optic faceplate 120, according to one embodiment of the invention, has a first column 212, a second column 214 and a third column 216. According to one embodiment of the invention, distance B is 98 microns. As discussed above, the invention is suitable to a wide range of dimensions. For example, distances A and B may be microns, as in the present illustration, or less, or may be more, such as millimeters, feet or miles or kilometers.

According to one embodiment of the invention, the overall dimensions of the second fiber optic faceplate 120 are similar to those of the first fiber optic faceplate 110. However, the invention is not so limited. The first fiber optic faceplate 110 may be sized so as to be no larger than the arrangement of optical fibers 130 mounted thereon. Considerations involved in sizing the second fiber optic faceplate 120 involve interfacing the second fiber optic faceplate 120 with the optic sensor 200 and specifically, the sensor elements of the optical sensor 200.

Figure 4 illustrates the optical fibers 130 mounted between the first fiber optic faceplate 110 and the second fiber optic faceplate 120. A first optical fiber 132, a second optical fiber 134 and a third optical fiber 136 are shown for illustrative purposes only as corresponding to the upper-most pixels of the columns of the fiber optic

faceplates. Specifically, the first optical fiber 132 is mounted to a first column 112 of the first fiber optic faceplate 110 and the first column 212 of the second fiber optic faceplate 120. The invention is not so limited, and may include coupling different columns among the fiber optic faceplates. For example, the first column 112 of the first fiber optic faceplate 110 may be coupled to the third column 216 of the second fiber optic faceplate 120.

Also, for purposes of illustration, the optical fibers 130 are drawn as corresponding only to the top row of pixels. According to an embodiment of the invention, each pixel of the first fiber optic faceplate 110 is optically coupled by the use of an optical fiber 130 to a pixel of the second fiber optic faceplate 120. According to a variation of an embodiment of the invention, pixels of different rows may be optically coupled to each other among fiber optic faceplates. For example, a top pixel of the first column 112 of the first fiber optic faceplate 110 may be coupled to a pixel approximately half way along the length of the second column 214 of the second fiber optic faceplate 120.

The optical fibers 130 may be mounted to the fiber optic faceplates 110, 120 by the use of an adhesive, such as glue, or by the use of a grid sized to hold the ends of the optical fibers 130 without the use of an adhesive, such as by the use of a compressive force.

Figure 5 illustrates an optical sensor 200 having sensor elements arranged linearly. Specifically, a first sensor element 222, a second sensor element 224, and a third sensor element 226 are provided on a face 201 of the optic sensor 200. The optical

sensor 200, according to one embodiment of the invention may be a tri-linear CCD image sensor such as the Kodak 2098 x 3 Tri-Linear CCD image sensor, model number: KLI-2113, manufactured by Eastman Kodak Company. The optical sensor 200 may be a color optical sensor or may be black and white.

According to a variation of an embodiment of the present invention, color filters may be used in conjunction with the optical fibers 130 so as to provide only limited colors to a sensor element. By way of example, as illustrated in Figure 4, color filters 139 are mounted on optical fibers 130 so as to limit the transmission of various colors through the optical fibers 130. A wide variety of other filtering arrangements are also within the scope of the invention. For example, a sheet filter may be coupled to the second fiber optic faceplate 120 and arranged with one of the columns 212, 214, 216 of the second fiber optic faceplate 120. By the use of such color filtering, a black and white optical sensor 200 having multiple sensor elements is capable of producing a color image. Specifically, by the use of the color filters 139, each black and white sensor element 222, 224, 226 is assigned a color. Therefore, by filtering the optical image read by each of the sensor elements, each image, such as red, green or blue, read by an optical sensor is equivalent to the reading obtained by a color optical sensor.

According to an embodiment of the invention, the spacing and configuration of the mounting of the optical fibers 130 on the second fiber optic faceplate 120 corresponds to the arrangement of the sensor elements 222, 224, 226 on the face 201 of the optical sensor 200. The invention is not so limited however, and may include optical fibers mounted to the second fiber optic faceplate 120 that do not correspond to a sensor element of the optical sensor. Such additional optical fibers may be ignored by the

optical sensor and/or may be used for other signaling or communication purposes within the scope of the invention.

The second fiber optic faceplate 120 may be securely mounted to the optical sensor 200 by the use of brackets or an adhesive. There is no requirement that the first fiber optic faceplate be securely mounted to either the second fiber optic faceplate or the optical sensor 200, as the optical fibers 130 allow for relative movement of the first fiber optic faceplate 110. Ideally, the first fiber optic faceplate 110 will be securely mounted to a frame that provides a stable orientation toward the field of view 10.

According to a variation of an embodiment of the invention, the second fiber optic faceplate 120 may be omitted, allowing direct mounting of the optical fibers 130 to the sensor elements 222, 224, 226 of the optical sensor 200.

According to an alternative embodiment of the invention, an optical sensor system 500 is provided as illustrated in Figure 6. The optical sensor system 500 includes a gap reduction apparatus 400 formed by the use of spacers 440 to arrange optical fibers 130 to correspond to sensor elements 222, 224, 226 of optical sensor 200, as discussed above. At an opposite end of the optical fibers 130, the optical fibers are ideally arranged approximate to each so as to minimize a separation between them, thereby minimizing the separation of the optical image obtained. Although spacers 440 are illustrated in Figure 6 as wedges extending along the length the optical fibers 130, the invention is not so limited. Specifically, spacers 440 may be used only at the end of the optical fiber approximate to the optical sensor 200.

According to an embodiment of the invention, the gap reduction apparatus 400 is formed by the use of adhesive to mount the optical fibers130 to each other at a side 402 distant from the optical sensor 200 and to mount the optical fibers 130 to the spacers 440 and to each other at a side 404 approximately to the optical sensor 200. Alternatively, other forms of mounting optical fibers 130 to each other and/or to the spacers 440 may be used. Examples include a band surrounding ends of the gap reduction apparatus 400 or a compressive wrapping arranged to maintain the configuration of the sides 402, 404 of the gap reduction apparatus.

These examples are meant to be illustrative and not limiting. The present invention has been described by way of example, and modifications and variations of the exemplary embodiments will suggest themselves to skilled artisans in this field without departing from the spirit of the invention. Features and characteristics of the above-described embodiments may be used in combination. The preferred embodiments are merely illustrative and should not be considered restrictive in any way. The scope of the invention is to be measured by the appended claims, rather than the preceding description, and all variations and equivalents that fall within the range of the claims are intended to be embraced therein.

Having described the invention, what is claimed as new and protected by Letters Patent is:

What is claimed is:

1. An optical sensor system for effectively reducing a non-active gap, comprising:

a tri-linear optical sensor having a first linear sensor element and a second linear sensor element separated by a first non-active gap having a first width and a third linear sensor element separated from said second linear sensor element by a second non-active gap having a second width;

a first optical fiber having a first end oriented toward a field of view and a second end mounted to a first linear sensor of said linear sensor elements;

a second optical fiber having a first end oriented toward said field of view and located a first distance, less than said first width, from said first end of said first optical fiber and a second end mounted to a second linear sensor of said linear sensor elements;

a third optical fiber having a first end oriented toward said field of view and located a third distance, less than said second width, from said first end of said second optical fiber and a second end mounted to a third linear sensor of said linear sensor elements.

2. The apparatus of claim 1, wherein said first optical fiber includes a plurality of optical fibers and said second optical fiber includes a plurality of optical fibers and said third optical fiber includes a plurality of optical fibers.

3. The apparatus of claim 1, wherein each optical fiber corresponds to a segment of said tri-linear optical sensor.

4. The apparatus of claim 1, wherein multiple optical fibers correspond to a segment of said tri-linear optical sensor.

5. The apparatus of claim 1, further comprising a plurality of color filters used with said optical fibers so as to separate colors provided to said linear sensor elements of said optical sensor.

6. An apparatus for effectively reducing a non-active gap of an optical sensor, comprising:

a first fiber optic faceplate configured to accommodate a plurality of optical fibers;

a second fiber optic faceplate configured to accommodate said plurality of optical fibers;

a first optical fiber of said plurality of optical fibers having a first end mounted to said first fiber optic faceplate and a second end mounted to said second fiber optic faceplate;

a second optical fiber of said plurality of optical fibers having a first end mounted to said first fiber optic faceplate a first distance, less than said non-active gap, from said first optical fiber and said second optical fiber having a second end mounted to said second fiber optic faceplate such that said second end of said first optical fiber and said second end of said second optical fiber are spaced to align with a first linear array and a second linear array, respectively, of a multiple-linear array image sensor.

7. The apparatus of claim 6, wherein said plurality of optical fibers includes a plurality of said first optical fibers and a plurality of said second optical fibers.

8. The apparatus of claim 7, wherein said plurality of said first optical fibers are mounted so as to form a first line along said first fiber optic faceplate and a second line along said second fiber optic faceplate and wherein said plurality of said second optical fibers are mounted so as to form a third line along said first fiber optic faceplate and a fourth line along said second fiber optic faceplate.

9. The apparatus of claim 6, wherein each optical fiber of said plurality of optical fibers corresponds to a segment of said multiple-linear array image sensor.

10. The apparatus of claim 6, wherein multiple optical fibers of said plurality of optical fibers correspond to a segment of said multiple-linear array image sensor.

11. The apparatus of claim 6, further comprising a third optical fiber of said plurality of optical fibers having a first end mounted to said first fiber optic faceplate a distance from said first end of said second optical fiber less than said non-active gap and a second end mounted to said second fiber optic faceplate such that said second end of said third optical fiber is located to align with a third linear array of a multiple-linear array image sensor.

12. The apparatus of claim 6, wherein said first ends of said first optical fiber and said second optical fiber are mounted normal to a plane formed by said first fiber optic faceplate and said second ends of said first optical fiber and said second optical fiber are mounted normal to a plane formed by said second fiber optic faceplate.

13. The apparatus of claim 6, further comprising said optical sensor mounted to said second fiber optic faceplate.

14. The apparatus of claim 13, wherein said optical sensor is a tri-linear CCD image sensor.

15. The apparatus of claim 6, further comprising a plurality of color filters used with said plurality of optical fibers so as to separate colors provided to said arrays of said optical sensor.

16. An apparatus for effectively reducing a non-active gap of an optical sensor, comprising:

a first optical fiber and a second optical fiber mounted to each other such that a first end of said first optical fiber and a first end of said second optical fiber are oriented toward a field of view; and

a first spacer mounted between a second end of said first optical fiber and a second end of said second optical fiber to locate said second end of said first optical fiber and said second end of said second optical fiber further apart than said first end of said first optical fiber and said first end of said second optical fiber and to correspond to elements of an optical sensor.

17. The apparatus of claim 16, further comprising,

a second spacer; and

a third optical fiber having a first end oriented toward said field of view and a second end located such that said second end of said third optical fiber and said second

end of said second optical fiber are further apart than said first end of said third optical fiber and said first end of said second optical fiber and to correspond to elements of an optical sensor; wherein said optical sensor is a tri-linear optical sensor.

18. The apparatus of claim 16, further comprising a plurality of color filters used with said optical fibers so as to separate colors provided to said elements of said optical sensor.

19. A method of effectively reducing a non-active gap of an optical sensor, comprising the steps of:

providing a tri-linear optical sensor having a first linear sensor element and a second linear sensor element separated by a first non-active gap having a first width and a third linear sensor element separated from said second linear sensor element by a second non-active gap having a second width;

orienting a first end of a first optical fiber toward a field of view;

mounting a second end of said first optical fiber to said first linear sensor element;

locating a first end of a second optical fiber a first distance, less than said first width, from said first end of said first optical fiber and oriented toward said field of view;

mounting a second end of said second optical fiber to said second linear sensor element;

locating a first end of a third optical fiber a third distance, less than said second width, from said first end of said second optical fiber and oriented toward said field of view;

mounting a second end of said third optical fiber to said third linear sensor element.

20. The method of claim 19, further comprising the step of providing a color filter for each of said optical fibers to filter colors reaching each of said linear sensor elements, thereby allowing said tri-linear optical sensor to serve as a color tri-linear optical sensor, even if the linear sensor elements are not color-sensitive.

Abstract

An apparatus to effectively reduces the non-active detection gap between sensor elements of an optical sensor is provided. While applicable to a wide range of optical sensors, the invention is particularly beneficial in accurately detecting aspects of a variable-rate dynamic colorful object using a tri-linear color CCD sensor. In one embodiment, optical fibers extend from a first fiber optic faceplate to a second fiber optic faceplate. The first fiber optic faceplate positions the optical fibers close together, while the second fiber optic faceplate separates the optical fibers to position them to correspond with the sensor elements of an optical sensor, or the fibers are directly mounted to the sensor elements. In another embodiment, a spacer is used to separate the optical fibers for alignment with the sensor elements and the other end of the optical fibers are attached to each other.

Confirmation Report–Memory Send

Time : Sep-28-01 05:51pm
Tel line 1 : 6177424214
Tel line 2 : 6177424214
Name : LAHIVE & COCKFIELD, LLP

Job number	:	280
Date	:	Sep-28 05:47pm
To	:	16072732967
Document Pages	:	07
Start time	:	Sep-28 05:47pm
End time	:	Sep-28 05:51pm
Pages sent	:	07

Job number : 280 *** SEND SUCCESSFUL ***

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Facsimile Cover Sheet

To: Dr. Eric P. Krantz
Company: Lynx System Developers, Inc.
Location: Woburn, MA
Phone: (607) 273-2967
Fax: (607) 273-2967

From: David J. Rikkers
Phone: (617) 227-7400
Fax: (617) 742-4214
Our Ref. No.: LSR-013

Date: 09/28/01
Sent By:
Pages including this cover page: 7

Message:

EXHIBIT 4

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

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Facsimile Cover Sheet

To: Dr. Eric P. Krantz
Company: Lynx System Developers, Inc.
Location: Woburn, MA
Phone: (607) 273-2967
Fax: (607) 273-2967

From: David J. Rikkers
Phone: (617) 227-7400
Fax: (617) 742-4214
Our Ref. No.: **LSR-013**

Date: 09/28/01
Sent By:
Pages including this cover page: 7

Message:

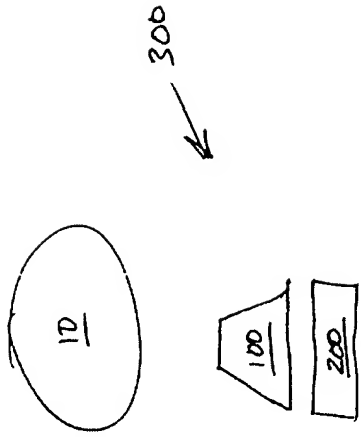

FIGURE 1

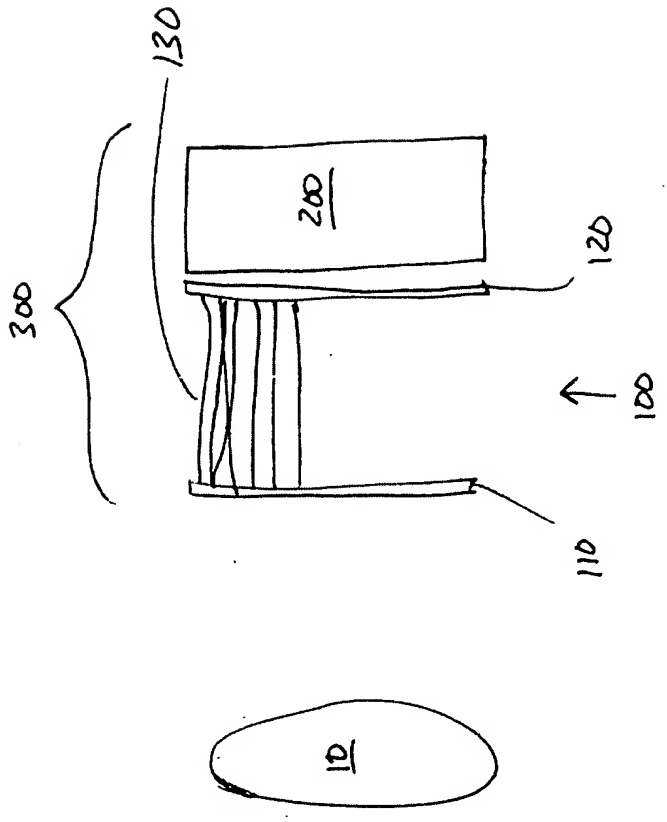

FIGURE 2

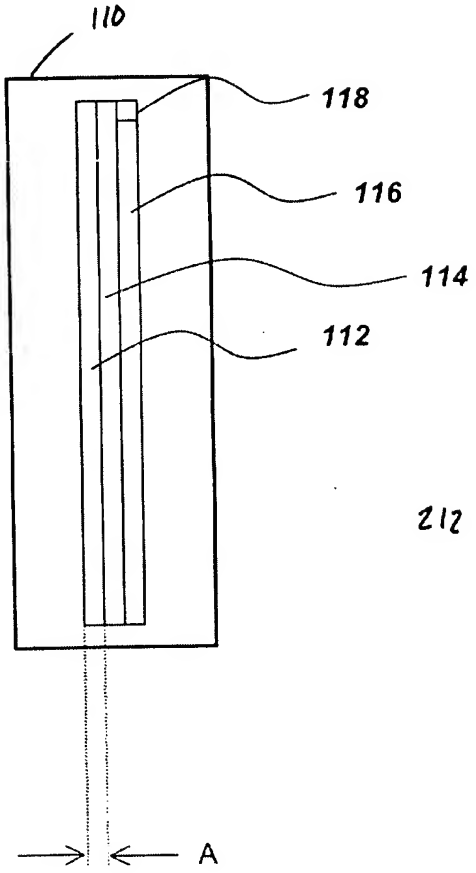

FIGURE 3A

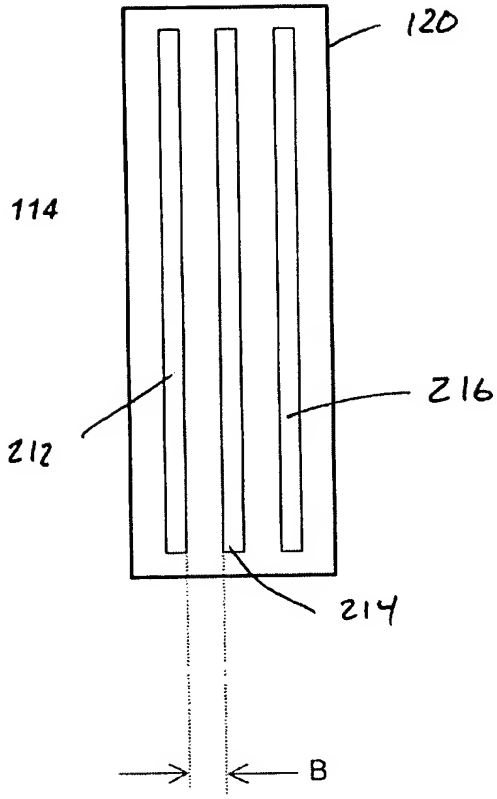

FIGURE 3B

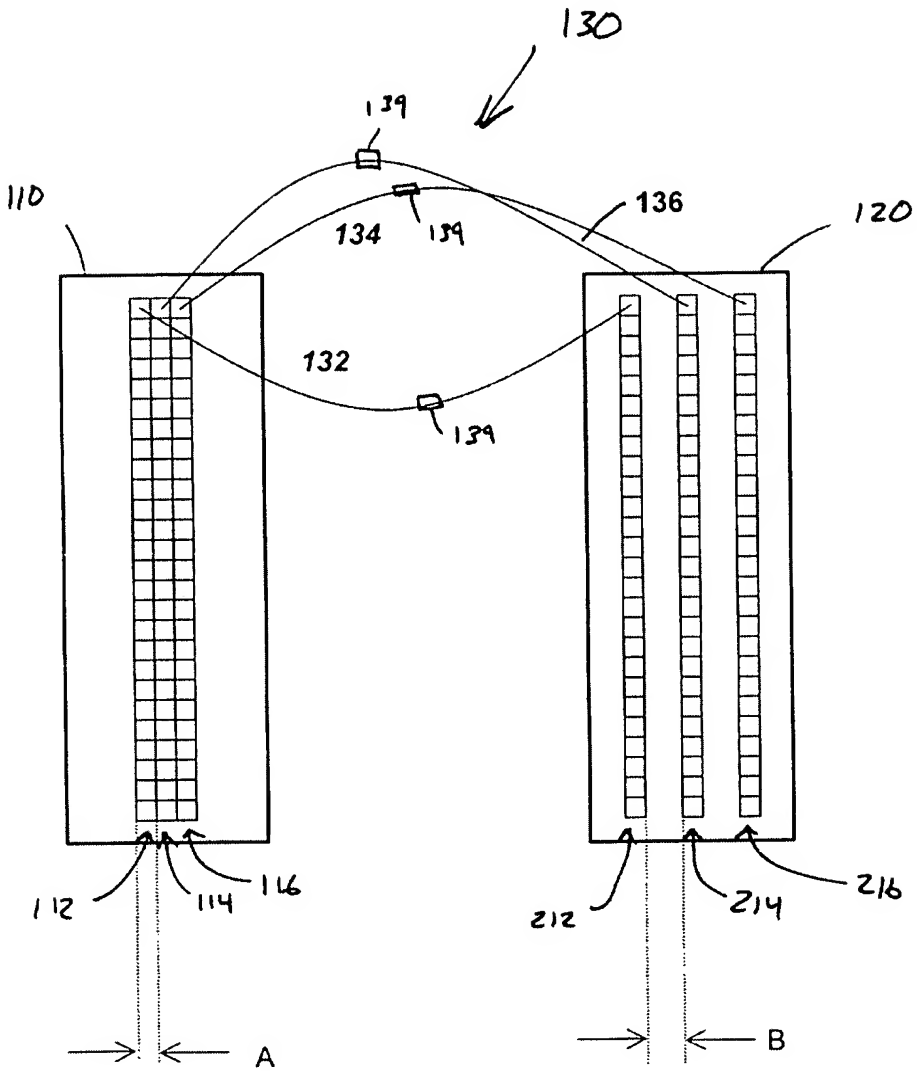

FIGURE 4

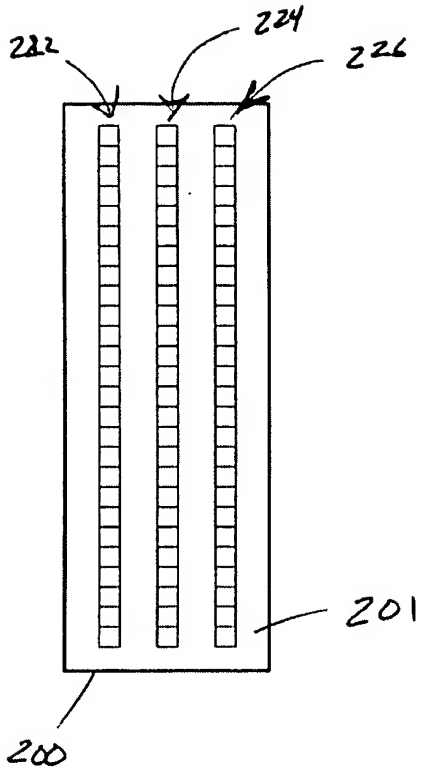

FIGURE 5

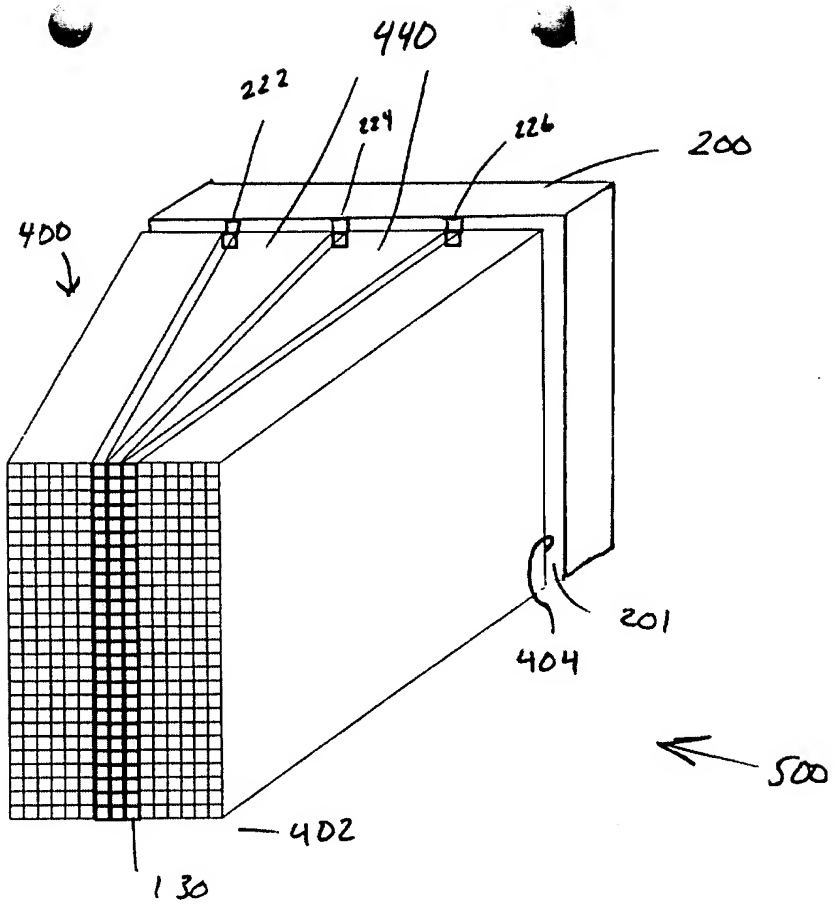

FIGURE 6

From: "Douglas J. DeAngelis" <ddean@finishlynx.com>
To: Eric P Krantz <epkrantz@finishlynx.com>
Date: 10/7/01 7:41PM
Subject: Re: LSR-013

I have had a chance to review the draft of this (albeit not all that closely). I have the following comments:

Although it is difficult to slog through the legalese, it seemed to me that (although other alternatives are mentioned in the discussion) the claims are directed against a tri-linear sensor (singular). The easiest way to get around this would then be to use three separate linear sensors (plural). Alternatively, you could use a single line taken out of three separate matrix sensors. I can even imagine an application in which you entirely change the configuration of the sensors in use. Say you have 3 b/w sensors each with 2K sensing elements. Using this technique I can (presumably) create a focal plane with 6K fibers arranged in a single vertical line and filtered RGB at the focal plane. Every third fiber goes to each individual B/W sensor (in effect, creating a co-linear sensor much like the Sony sensor we currently use). This has the added advantage that you can use B/W linear sensors (of which there is a much greater selection, and which have much better speed characteristics). Actually, having just come up with this, I really like it. Eric, I presume this is too hard to manufacture in todays technology?

Another problem we have is that we would like to be able to see on the computer a low-res 2D image of the field of view of the camera (for alignment purposes) as well as have the 1D image for capturing. Presumably one could arrange a faceplate for this application. It could have a sparse matrix of fibers (say, 512x384) spread out over the full focal plane which get compressed down to a matrix sensor as well as a separate set of fibers down the center that get directed toward the linear sensor. Again, probably hard to manufacture today, but is that a reason not to have it covered in the claims?

Anyway, you get the drift. I can come up with others if pressed. The point is that I think it is safe to say (Eric surely knows better) that no one has done this yet with *any* type of sensor, so it seems as though what we should be claiming is the ability to effectively create a focal plane of any sort at one point in space, and then rearrange the pixel elements of that focal plane *in any way* before they get to whatever kind of sensing elements are in use. Anything less does not capture the full generality of the invention. Obviously if we have found some prior art that argues against this, then we can dumb down the application as needed and it is still useful. But I think we should go for as much generality as we can reasonably obtain in one application. And I don't think this means adding 50 claims. Our compression application is nice and general, and has just a few claims.

==========

On an entirely different subject, REDACTED - CONFIDENTIAL

REDACTED - CONFIDENTIAL

Thanks for listening to me rant.

-doug
--
==========

Douglas J. DeAngelis Lynx System Developers, Inc.
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781-935-6959 781-938-0580 fax Woburn, MA 01801
800-989-LYNX http://www.finishlynx.com

==========

CC: <djr@lahive.com>, <ral@lahive.com>

From: Eric P Krantz <epkrantz@finishlynx.com>
To: <djr@lahive.com>
Date: 11/14/01 12:29PM
Subject: LSR-013 additional prefferred embodiment

Dave,

Crude graphics in this diagram, but hopefully sufficient
to get the point across for now.

A preferred embodiment [for camera alignment purposes]:
> To incorporate the fiber
> component as perhaps a single larger faceplate where the
> center 3 lines are used for 1d capture and the "pass-through"
> fibers create a broader image of the field of view.
> Like a picture with the center 3 lines cut out.

Or, more generally:
> Not a strict requirement for the center three lines to be entirely
> "removed" from the field of view of the matrix of fibers (fig. 6),
> but rather that the matrix could
> potentially be interleaved into the fibers that are directed at the
> linear sensor. This seemed to make sense to me particularly if the
> fibers are round. It is difficult to draw this in ASCII, but I will
> give it a whirl. In the drawing below, imagine an "L" is a round fiber
> directed at the linear sensor and an "M" is a round fiber directed at
> the matrix sensor:

```
    L L L
M M M M M M M M
    L L L
M M M M M M M M
    L L L
M M M M M M M M
    L L L
```

-Eric

==========

Dr. Eric P. Krantz
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==========

EXHIBIT 6

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Collimated Holes, I, 09:13 AM 7/22/02 , Re: Project Status

Received: from mta7.pltn13.pbi.net [64.164.98.8] by finishlynx.com with ESMTP
(SMTPD32-7.10) id AF5A11801C6; Mon, 22 Jul 2002 12:14:18 -0400
Received: from netcomputer ([64.175.248.166])
by mta7.pltn13.pbi.net (iPlanet Messaging Server 5.1 (built May 7 2001))
with SMTP id <0GZN00FNARQMA4@mta7.pltn13.pbi.net> for epkrantz@finishlynx.com;
Mon, 22 Jul 2002 09:13:35 -0700 (PDT)
Date: Mon, 22 Jul 2002 09:13:34 -0700
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Re: Project Status
To: Eric P Krantz <epkrantz@finishlynx.com>
Message-id: <004c01c2319a$bb022600$74a4fea9@netcomputer>
MIME-version: 1.0
X-MIMEOLE: Produced By Microsoft MimeOLE V5.50.4133.2400
X-Mailer: Microsoft Outlook Express 5.50.4133.2400
Content-type: text/plain; charset=iso-8859-1
Content-transfer-encoding: 7bit
X-Priority: 3
X-MSMail-priority: Normal
References: <3.0.6.32.20020719161849.007a79d0@xenia.media.mit.edu>
X-RCPT-TO: <epkrantz@finishlynx.com>
Status: U
X-UIDL: 323325785

Eric,

Thanks for your note.

We are still trying to resolve one of the more difficult aspects of the project -- the central ribbon. Although we have successfully drawn ribbons in the past weeks, none has been good enough to build into the assembly. We are making another run this week and hope that we can incorporate it between the side elements. I will let you know about this latest attempt later on this week.

Regards,

Dick

----- Original Message -----
From: "Eric P Krantz" <epkrantz@finishlynx.com>
To: <chi_2000@pacbell.net>
Sent: Friday, July 19, 2002 1:18 PM
Subject: Project Status

> Dick,
>
> Could you please update me on any progress or otherwise
> difficulties on the protoype windows?
> We have in hand several more Kodak Kli 2113 sensors ready
> to send as you require.
>
> Regards,
> Eric
>
>
> ==========
> Dr. Eric P. Krantz Lynx System Developers, Inc.
> epkrantz@finishlynx.com 175-N New Boston Street
> Home office: (607) 273-2967 Woburn, MA 01801
> 781-938-0580 fax
> http://www.finishlynx.com

Julie A. Cipullo - LSR-013 - Draft Application Comments

From: David J. Rikkers
To: Eric P Krantz
Date: 8/14/02 4:31 PM
Subject: LSR-013 - Draft Application Comments
CC: Douglas J. DeAngelis; Ralph A. Loren

Draft Patent Application for: METHOD AND APPARATUS TO EFFECTIVELY REDUCE A NON-ACTIVE DETECTION GAP OF AN OPTICAL SENSOR

Eric:

Further to our July 19, 2002 e-mail, we look forward to any comments on the draft patent application. Please be sure to review the application to verify that it completely and accurately describes your invention and the best known mode for practicing the invention. Thank you.

David J. Rikkers, Esq.
Lahive & Cockfield, LLP
28 State Street
Boston, MA 02109
djr@lahive.com
617-994-0788 direct dial
617-227-7400
617-742-4214 fax

EXHIBIT 7

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Collimated Holes, I, 04:20 PM 8/29/02 , Progress, painful progress

Date: Thu, 29 Aug 2002 16:20:33 -0700
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Progress, painful progress
To: Eric P Krantz <epkrantz@finishlynx.com>
X-MIMEOLE: Produced By Microsoft MimeOLE V5.50.4133.2400
X-Mailer: Microsoft Outlook Express 5.50.4133.2400
X-MSMail-priority: Normal
X-RCPT-TO: <epkrantz@finishlynx.com>

Eric,

The most difficult part to date has been the creation of a 14-micron ribbon which is large enough in the other direction to be handled. We finally got it.

We are assembling the parts now to fuse and epoxy, to determine the better method. Our current sense (subject to change with the weather) is that fusing is going to be much more satisfactory. I will try to update you late next week or early the following.

Regards,

Dick

LAHIVE & COCKFIELD LLP

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BOSTON, MASSACHUSETTS 02109-1784
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FAX (617) 742-4214
lc@lahive.com

September 20, 2002

Dr. Eric P. Krantz
Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801

Re: Updated Draft Utility Patent Application
"*Method and Apparatus to Effectively Reduce a Non-Active Detection Gap of an Optical Sensor*"
Our Reference: LSR-013

Dear Eric:

Further to our e-mails of July 19, 2002 and August 14, 2002, we look forward to your comments on the above-identified draft patent application. We would like to proceed to file this application as soon as possible.

We look forward to hearing from you. Please contact us with any questions.

Sincerely,

LAHIVE & COCKFIELD, LLP

David J. Rikkers

DJR/jac
cc: Mr. Douglas J. DeAngelis
Ralph A. Loren, Esq.

From: Eric P Krantz <epkrantz@finishlynx.com>
To: <Ral@lahcoc.com>, <djr@lahive.com>
Date: 9/29/02 11:42AM
Subject: LSR-013 comments pending

Ralph and Dave,

We are anxiously awaiting some crucial production results
that may affect the patent filing.
Please hold on patent filing LSR-013 pending imminent
further comments.

Eric

==========

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==========

CC: <ddean@finishlynx.com>

Collimated Holes, I, 02:56 PM 10/8/02 , Re: project status

Date: Tue, 08 Oct 2002 14:56:46 -0700
From: "Collimated Holes, Inc." <chi_2000@pacbell.net>
Subject: Re: project status
To: Eric P Krantz <epkrantz@finishlynx.com>
X-MIMEOLE: Produced By Microsoft MimeOLE V5.50.4133.2400
X-Mailer: Microsoft Outlook Express 5.50.4133.2400
X-MSMail-priority: Normal
X-RCPT-TO: <epkrantz@finishlynx.com>

Eric,

We have just completed a moderately successful epoxy-method trial. Our goal in this essay was to examine the minimum gap achievable on both sides of a spaced array of 14um thick ribbons, when compressed between two glass plates and held in place with epoxy. The ribbons were spaced several widths apart in order to eliminate any possibility of ribbon overlap during this experiment. We used small fiberoptic faceplates with extremely flat surfaces (polished to within 6 fringes) in place of the biased fiberoptics for this trial, to save the precision-ground biased pieces for trials which could potentially lead to testable parts (so there is no need to worry when you notice that the fiber orientation is perpendicular to that of the ribbons!).

The attached photograph displays our result - a tightly fit fiberoptic ribbon of 14um thickness with a few microns of epoxy-filled space on the bottom side, and approximately one micron of space between the ribbon and the plate on the top side. This is encouraging, because the narrow gap at the top seems to indicate that it would be possible to reduce the thickness of the larger gap to one micron or less.

We are currently preparing to run more trials, using the fusion method and a more closely spaced ribbon version of the epoxy approach. We will be sure to keep you updated as to our progress.

Best Regards,
Matt Fate

----- Original Message -----
From: "Eric P Krantz" <epkrantz@finishlynx.com>
To: <chi_2000@pacbell.net>
Sent: Thursday, October 03, 2002 9:29 PM
Subject: project status

> Dick,
>
> Can you please update me on any progress or setbacks
> in the process.
>
> Thanks,
>
> Eric
> ==========
> Dr. Eric P. Krantz Lynx System Developers, Inc.
> epkrantz@finishlynx.com 175-N New Boston
Street
> Home office: (607) 273-2967 Woburn, MA 01801
> 781-938-0580 fax
> http://www.finishlynx.com
> ==========
>

Attachment Converted: "c:\eudora\attach\10-8-02 14um gap.jpg"

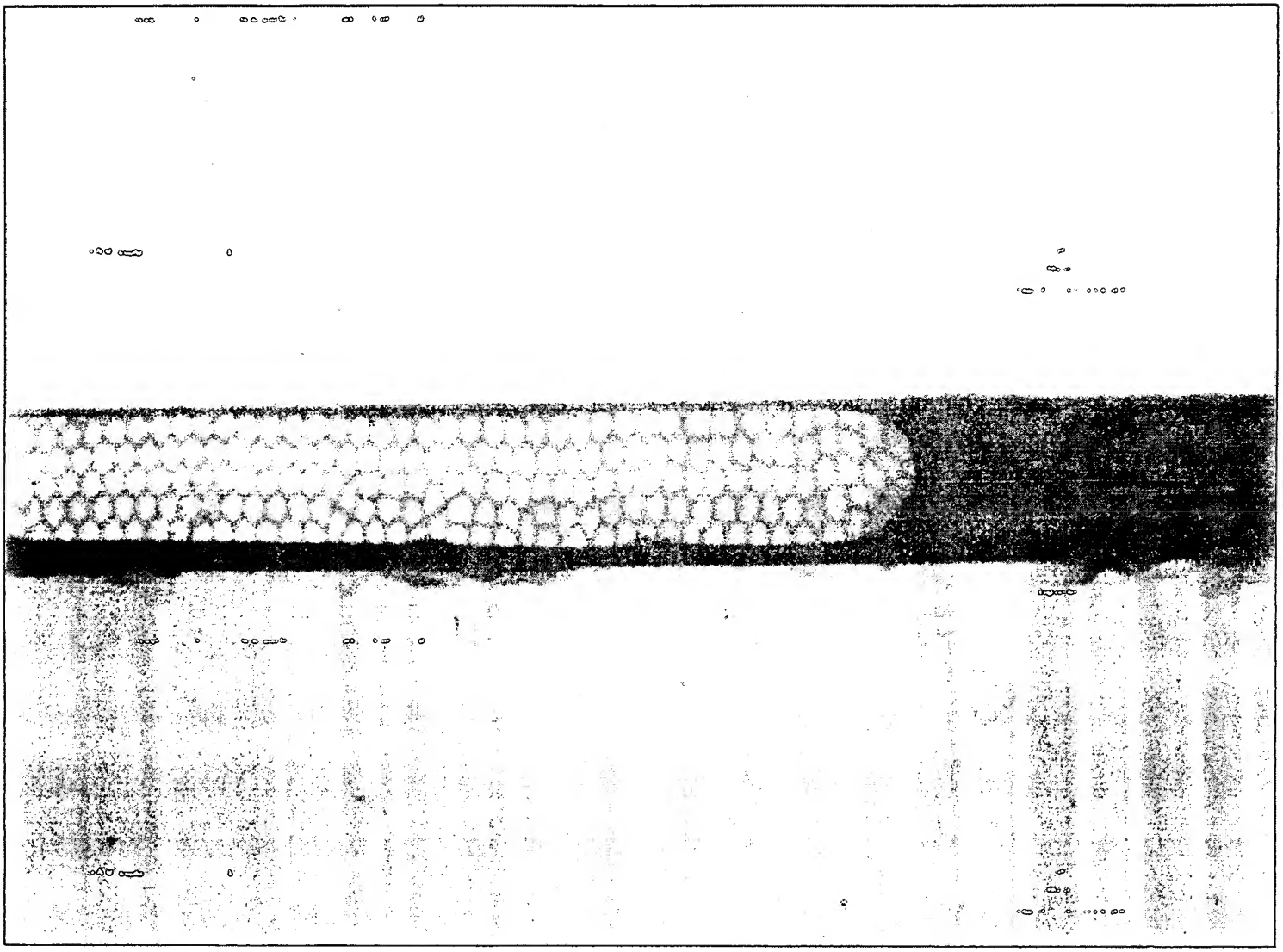

EXHIBIT 7

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Julie A. Cipullo - Re: LSR-013 comments pending

From: David J. Rikkers
To: epkrantz@finishlynx.com
Date: 3/11/03 1:25 PM
Subject: Re: LSR-013 comments pending
CC: Ralph A. Loren

Eric:

Please give me a call to discuss the schedule for the fling of this patent application. We understand that you were doing some testing in September that may involve some changes to the current draft patent application. We would like to discuss this testing and incorporate whatever changes might be appropriate and get this application on file. If a decision has been made not to file this application, please let us know so that we may close our file.

Sincerely,
LAHIVE & COCKFIELD, LLP

David J. Rikkers, Esq.
Lahive & Cockfield, LLP
28 State Street
Boston, MA 02109
djr@lahive.com
617-994-0788 direct dial
617-227-7400
617-742-4214 fax

>>> "Douglas J. DeAngelis" <ddean@finishlynx.com> 12/12/02 02:14PM >>>
Eric-

Note that we have put thousands of dollars into this patent work already, so if we just drop it now it will be a big waste of money. We are close enough that we need to do it regardless of whether it ever becomes something that we can economically manufacture. I will let Dave correct me if I am wrong, but it is my understanding we can always *add* to the concepts in the patent at a later date. But we need to memorialize our current understanding now.

-doug
--

Douglas J. DeAngelis
ddean@finishlynx.com
781-935-6959 781-938-0580 fax
800-989-LYNX
Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801
http://www.finishlynx.com

EXHIBIT 7

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Julie A. Cipullo - Re: LSR-013 comments pending

From: "Eric Krantz" <epkrantz@finishlynx.com>
To: "David J. Rikkers" <djr@lahive.com>
Date: 3/14/03 9:08 AM
Subject: Re: LSR-013 comments pending

Dave,

Thanks for your patience.
There are significant changes to your last draft.
I will try to contact you on Monday to discuss them.

Sincerely,

Eric

---------- Original Message ----------
From: "David J. Rikkers" <djr@lahive.com>
Date: Tue, 11 Mar 2003 13:25:51 -0500

>Eric:
>
> Please give me a call to discuss the schedule for the fling of this
>patent application. We understand that you were doing some testing in
>September that may involve some changes to the current draft patent
>application. We would like to discuss this testing and incorporate
>whatever changes might be appropriate and get this application on file.
>If a decision has been made not to file this application, please let us
>know so that we may close our file.
>
>Sincerely,
>LAHIVE & COCKFIELD, LLP
>
>
>David J. Rikkers, Esq.
>Lahive & Cockfield, LLP
>28 State Street
>Boston, MA 02109
>djr@lahive.com
>617-994-0788 direct dial
>617-227-7400
>617-742-4214 fax
>
>
>**********
>This e-mail message contains a communication from a law office, which
>communication is strictly confidential and intended solely for the use
>of the addressee. The communication may be privileged under the
>attorney-client and/or the attorney work product privileges. Any
>non-addressee is prohibited from reading, disseminating, distributing or
>copying the communication contained herein. If you are in possession of
>this communication in error, please immediately notify the sender. Thank
>you.
>**********
>
>
>
>
>>>>> "Douglas J. DeAngelis" <ddean@finishlynx.com> 12/12/02 02:14PM >>>
>Eric-
>
>Note that we have put thousands of dollars into this patent work
>already, so if we just drop it now it will be a big waste of money. We
>are close enough that we need to do it regardless of whether it ever
>becomes something that we can economically manufacture. I will let Dave
>correct me if I am wrong, but it is my understanding we can always *add*
>to the concepts in the patent at a later date. But we need to
>memorialize our current understanding now.
>
>-doug
>--
>==========
>Douglas J. DeAngelis — Lynx System Developers, Inc.
>ddean@finishlynx.com — 175-N New Boston Street
>781-935-6959 781-938-0580 fax — Woburn, MA 01801
>800-989-LYNX — http://www.finishlynx.com
>==========

EXHIBIT 7

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

Julie A. Cipullo - Re: LSR-013 comments pending

From: Eric P Krantz <epkrantz@finishlynx.com>
To: "David J. Rikkers" <djr@lahive.com>
Date: 3/17/03 5:43 PM
Subject: Re: LSR-013 comments pending
CC: <ddean@finishlynx.com>

Dave,

Please find attached my revisions to LSR-013.
The prototype is proving to be quite difficult to make,
and it is not there yet.

I hope that my amendments are clear--
I look foward to your additional comments to wrap up
the initial filing.

Regards,

Eric

EXHIBIT 7

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

From: Eric P Krantz <epkrantz@finishlynx.com>
To: <djr@lahive.com>
Date: 3/28/03 3:39PM
Subject: LSR-013

Dave,
Thanks for your phone message.

Regarding the fiber optic "prescribed numerical aperture"
"at or near a focal plane" revision:

Let's talk on Monday if that is perhaps better left unchanged
to "field of view" which, although somewhat incomplete,
may cover a more broad interpretation.

I will plan to call you at 2:00 p.m. on Monday--
if this is a conflict for you, please let me know.

Thanks,

Eric

==========
Dr. Eric P. Krantz
epkrantz@finishlynx.com
Home office: (607) 273-2967

Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801
781-938-0580 fax
http://www.finishlynx.com
==========

Collimated Holes, I, 02:05 PM 5/12/03 , Update and Latest Images

From: "Collimated Holes, Inc" <chi_2000@pacbell.net>
To: "Eric P Krantz" <epkrantz@finishlynx.com>
Subject: Update and Latest Images
Date: Mon, 12 May 2003 14:05:59 -0700
X-MSMail-Priority: Normal
X-Mailer: Microsoft Outlook Express 6.00.2800.1158
X-MimeOLE: Produced By Microsoft MimeOLE V6.00.2800.1165
X-RCPT-TO: <epkrantz@finishlynx.com>

Dear Eric,

I hope that everything is going well with you. Attached you will find images of the most recent prototype, assembled approximately two weeks ago. We were able to draw straight, flat ribbons by fusing the ribbon draw preforms prior to their draw, which have allowed us to reduce the gaps on either side of the ribbon in the epoxied composite prototypes. Unfortunately, there was one ribbon in the linear array that ended up part way beneath it's neighbor, resulting in a tapering gap between the two exterior biased fiberoptics. This overlap was on one extreme end of the piece, so the spacing on the opposite end is still fairly good - the best to date - but not yet uniform or minimized, as is our goal. The attached images show views at varying levels of magnification of the side with the narrow part of the tapering gap.

This prototype used the last of the biased fiberoptic material (used for the exterior sections), so we are in the process of creating more of this material to allow for the stacking of additional test pieces. This additional material should be ready next week, at which time we will begin stacking another test piece. To assist in the stacking and alignment of the ribbons for this next effort, we are planning on using a Micro-Vu video measuring system that we recently brought on line, which will allow us to view the ribbon-stacking under magnification in real-time. Our expectation is that this will assist in preventing the accidental overlaps during stacking that have plagued the process thus far. I will update you as this effort progresses, and if you have any questions or comments, please don't hesitate to contact me.

Best Regards,
Matt

Attachment Converted: "c:\eudora\attach\4-24-03 Convergent Face 5X.jpg"

Attachment Converted: "c:\eudora\attach\4-24-03 Convergent Face 50X.jpg"

Attachment Converted: "c:\eudora\attach\4-24-03 Convergent Face 20X.jpg"

Received: from smtp802.mail.ukl.yahoo.com [217.12.12.139] by finishlynx.com
(SMTPD32-8.03) id A120D90170; Tue, 14 Oct 2003 20:13:20 -0400
Received: from adsl-67-121-191-190.dsl.sntc01.pacbell.net (HELO Photon) (chi?2000@pacbell.net@67.121.191.190 with login)
by smtp1.bt.mail.vip.ukl.yahoo.com with SMTP; 15 Oct 2003 00:13:13 -0000
Message-ID: <00b401c392b1$2011a5c0$ba37fea9@Photon>
From: "Collimated Holes, Inc" <chi_2000@pacbell.net>
To: "Eric P Krantz" <epkrantz@finishlynx.com>
References: <3.0.6.32.20031014093114.007b3260@finishlynx.com>
Subject: Re: Update and Latest Images
Date: Tue, 14 Oct 2003 17:13:10 -0700
MIME-Version: 1.0
Content-Type: text/plain;
charset="iso-8859-1"
Content-Transfer-Encoding: 7bit
X-Priority: 3
X-MSMail-Priority: Normal
X-Mailer: Microsoft Outlook Express 6.00.2800.1158
X-MimeOLE: Produced By Microsoft MimeOLE V6.00.2800.1165
X-IMAIL-SPAM-VALHELO: (14221680)
X-RCPT-TO: <epkrantz@finishlynx.com>
Status: R
X-UIDL: 339720602

Dear Eric,

It is good to hear from you again. We have not given up hope either, and will gladly continue work on functional prototypes with renewed focus.

After several failed attempts to draw fused ribbons (residual stresses caused the ribbon preforms to fracture during drawing, a problem that we have learned can be eliminated through an anneal cycle on the prepared ribbon preform) and to minimize the epoxy gap, we have come to the conclusion that the most promising approach entails fusing the drawn 14um thick ribbons between the opposing biased fiberoptic material. After closely examining the epoxied versions, we are no longer convinced that the gap can ever be eliminated to a sufficient degree with epoxy present. We expect that fusing the material will create a composite piece with little to no gap between the elements, and will remove the aqueous/lubricated epoxy environment that we believe assisted in the migration of placed ribbons - manifesting in the overlaps that we previously experienced. We are also going to try to increase the aspect ratio of the ribbons from 30:1 to 50:1, to make them easier to handle and more controllable, thereby diminishing the likelihood of accidental misplacement by assemblers, which also may have contributed to some of the overlaps.

Having used all of the ribbon material that we previously produced, our next step at this point is to draw more material to create the ribbons - which we will try to begin this week.

If you have any questions or comments, please feel free to contact me at your convenience. I will also stay in contact with you with more frequent updates as we progress.

I hope all is well with you, and appreciate your continued interest in the success of this project. We also remain interested, in spite of the difficulties to date.

Best Regards,
Matt

----- Original Message -----
From: "Eric P Krantz" <epkrantz@finishlynx.com>
To: "Collimated Holes, Inc" <chi_2000@pacbell.net>
Sent: Tuesday, October 14, 2003 6:31 AM

> Dear Dick and Matt,
>
> It is still my hope that something worthwhile will evolve
> from this this project.
> The timeline is now well beyond our original schedule.
> I understand the difficulites as best I can,
> and I ask that despite them we proceed to complete
> a best effort prototype.
> I ask that you please re-consider this project as a priority.
>
> I still believe that our best efforts will bring success
> and be worth the effort on several levels of satisfaction.
>
> Best Regards,
> Eric
>
>
> ==========
> Dr. Eric P. Krantz Lynx System Developers, Inc.
> epkrantz@finishlynx.com 175-N New Boston
Street
> Home office: (607) 273-2967 Woburn, MA 01801
> 781-938-0580 fax
> http://www.finishlynx.com
> ==========

From: Eric P Krantz <epkrantz@finishlynx.com>
To: <djr@lahive.com>
Date: 4/3/03 4:50PM
Subject: LSR-013 figures

Dave,

Please find 2 files attached regarding the manufacture of the prototype: one is in ms word format, the other is jpeg.

The jpeg file shows a cross-section of the prototype facing the field of view: note that the central ribbon is in fact somewhat curved and in segments rather than contiguous. for scale: the fiber size is approx. 14 microns diameter.

I look forward to the final draft, to include, as per our last conversation, mention of injection molding manufacture techniques.

Please also include some mention of "nanotechnology", however broadly phrased, as a manufacturing potential.

-Eric

CC: <Ral@lahcoc.com>

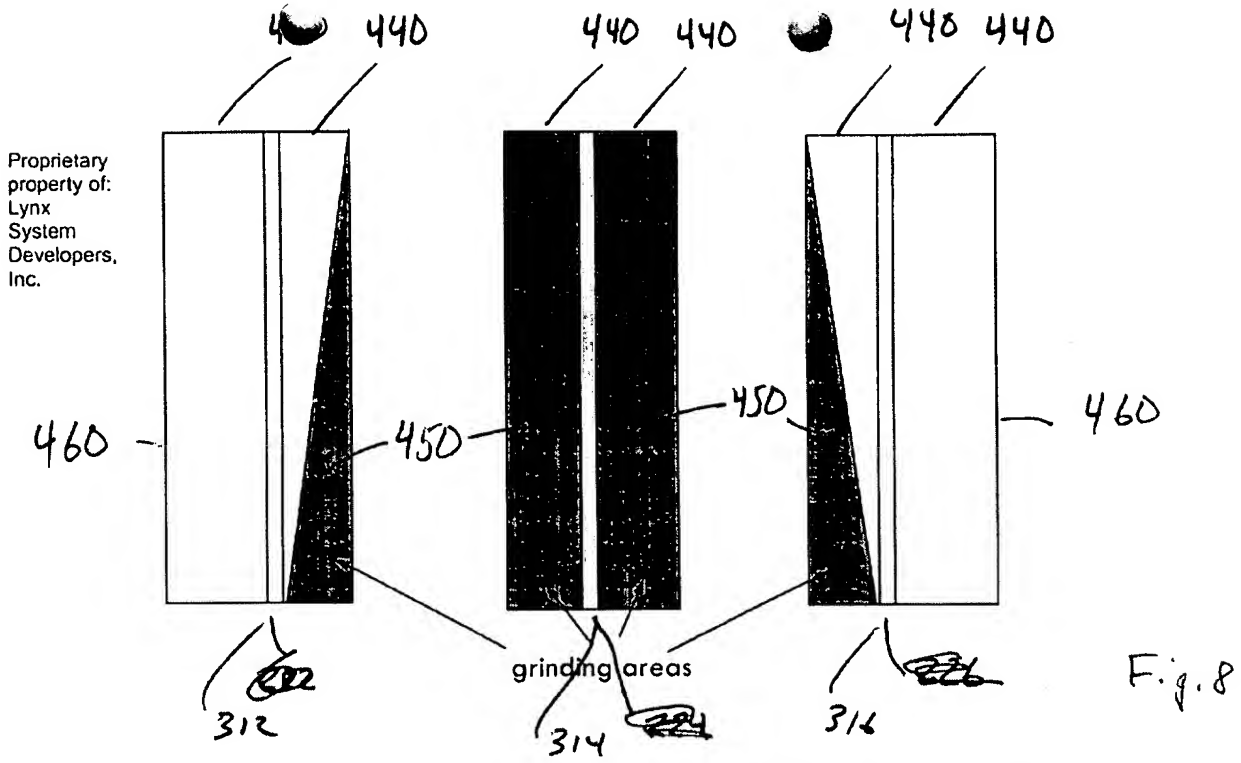

Fig. 8

Figure 1. Top view of tri-component prototype solution. Each component is manufactured from a similar block of 5 micron fibers and precision ground. Far left and right components are mirrored.

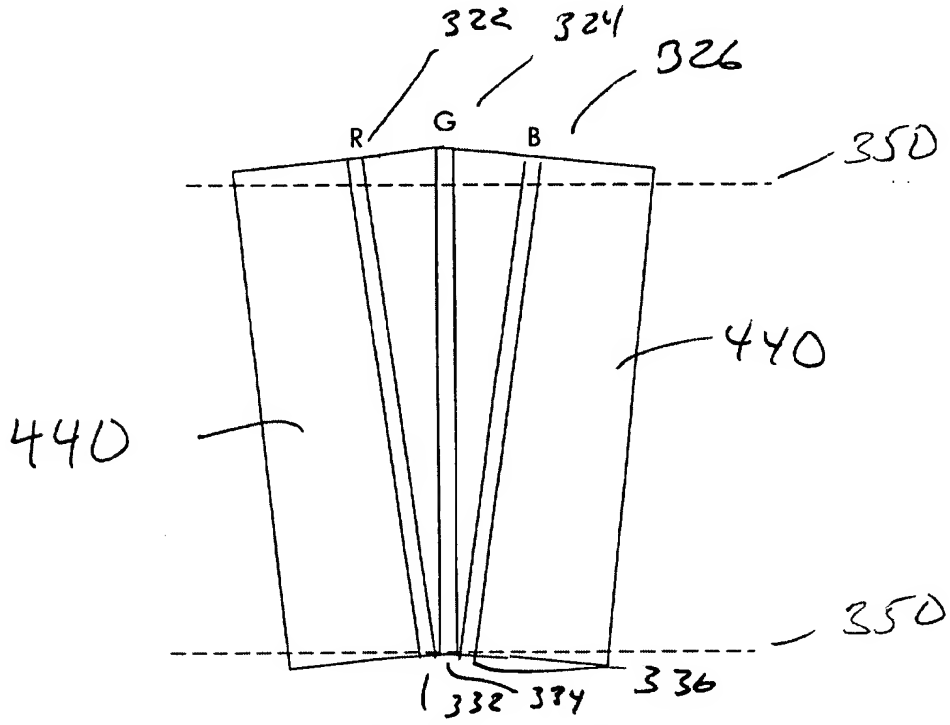

Figure 2. The three components are fused together by epoxy or heat treatment and ground at the planes shown by the dotted lines to conform to the chip specifications.

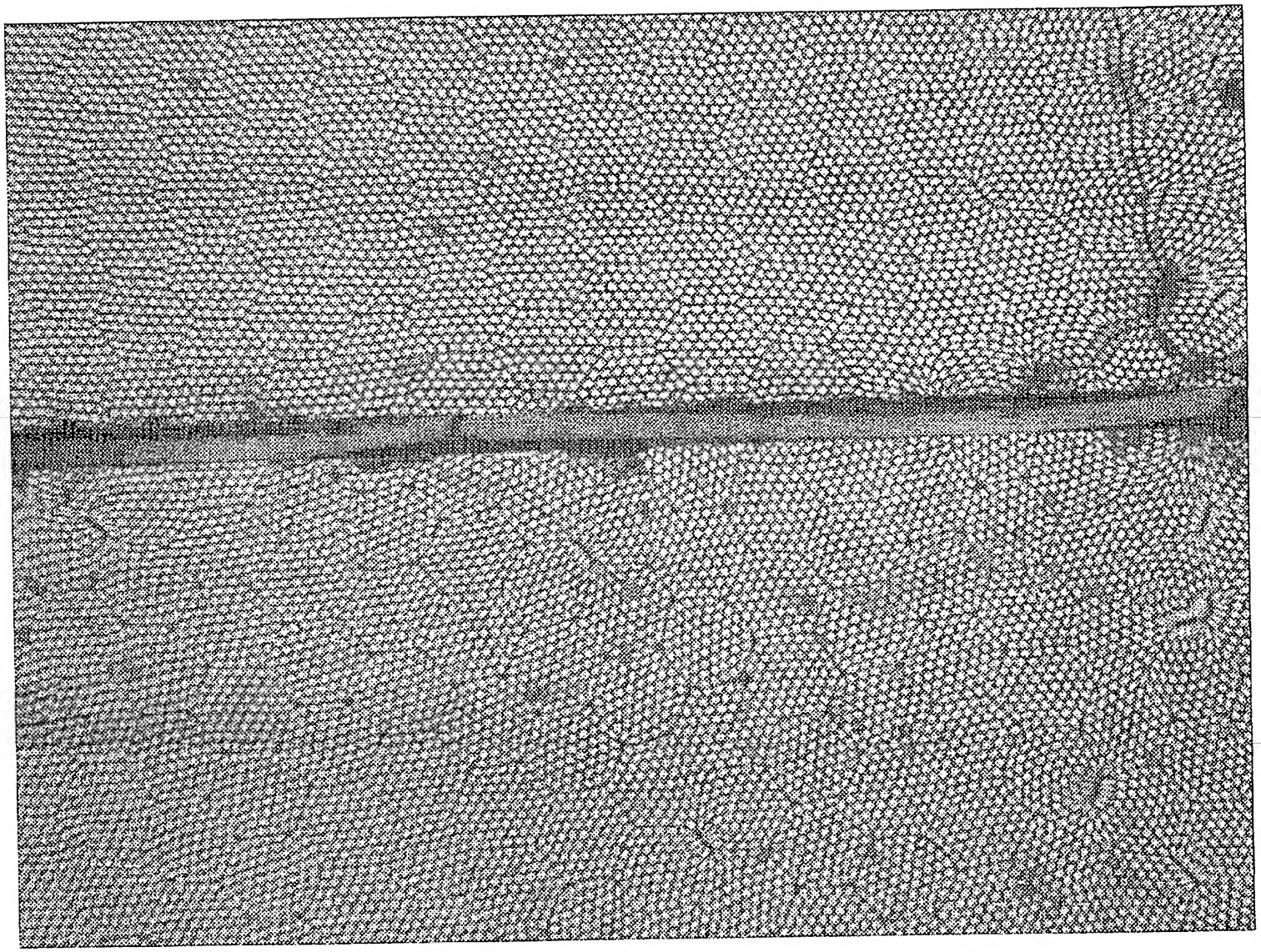

EXHIBIT 8

to the 37 CFR §1.131 Declaration of Krantz, DeAngelis and Sigel

From: David J. Rikkers
To: Douglas J. DeAngelis; Eric Krantz
Date: 6/18/03 5:18PM
Subject: Draft Application (Our ref.: LSR-013)

Re: Updated Draft Utility Patent Application
"Method and Apparatus to Effectively Reduce
a Non-Active Detection Gap of an Optical Sensor"
Our Reference: LSR-013

Dear Eric and Doug:

Thank you for your e-mails regarding additional material to be added to this patent application. An updated final draft of the patent application is attached in two files. The first file contains the text of the specification, while the second file contains the drawings.

Please read the attached application to verify that it completely and accurately describes your invention and the best known mode for practicing the invention. Also, please verify that the application sufficiently describes the invention to enable one of ordinary skill in the art to make and use the invention without undue experimentation. If all is in order, you may proceed to execute the attached Declaration, preferably in blue ink. If any changes at all appear necessary then do not sign this document, but call me. This is because the patent laws do not permit changes to the text once the application is signed. We understand that both of you are inventors of the claimed invention and have prepared the Declaration accordingly.

In our final review of the application, we raised the question of whether the invention can also be implemented by the use of an optical collector other than an optical fiber to provide the gap reduction. For example, could a quartz or other optical collector be oriented toward a field of view and providing a gap reduction. In such a case, optical fibers could then be used between the optical collector and an optical sensor. Please let us know if we should modify the application to incorporate this concept.

As discussed previously, we propose to incorporate the separate invention of providing a low-resolution, two-dimensional image for camera alignment purposes, described in Doug's October 7, 2001 e-mail, in a separate application, because it appears to be solving a different problem and could therefore be better addressed in its own application. Please let us know if you would like us to proceed with drafting the separate application.

Sincerely,
LAHIVE & COCKFIELD, LLP

David J. Rikkers, Esq.
Lahive & Cockfield, LLP
28 State Street
Boston, MA 02109
djr@lahive.com
617-994-0788 direct dial
617-227-7400
617-742-4214 fax

From: David J. Rikkers
To: Doug DeAngelis
Date: 6/19/03 4:27PM
Subject: Re: Draft Application (Our ref.: LSR-013)

Doug,

Please give me a call at your convenience to discuss the issues you noted below. In the event that the patent application remains unchanged, I have attached the assignment as previously discussed.

Sincerely,
LAHIVE & COCKFIELD, LLP

David J. Rikkers, Esq.
Lahive & Cockfield, LLP
28 State Street
Boston, MA 02109
djr@lahive.com
617-994-0788 direct dial
617-227-7400
617-742-4214 fax

>>> Doug DeAngelis <ddean@finishlynx.com> 06/18/03 11:27PM >>>
For the most part it looks pretty good for the linear case. The claims make my head hurt a bit. Once I get past 20 claims in a patent my eyes always start to glaze over a bit.

Is it really necessary to mention the Kodak part number so specifically? This kind of thing is a bit of a trade secret.

I really don't want to complicate things at this very late stage, but I am a little concerned about the reliance on the time-delay argument for wanting to overcome a non-active gap. It would be just as straightforward to use something like this to (for example) turn two (or more) 2000 pixel linear arrays into something which acted like a 4000 pixel linear array. Or (I assume - Eric can correct me) to turn four 1000x1000 pixel matrix arrays into something which acted like a single 2000x2000 pixel array. For applications that need *lots* of pixels applied to a single field of view, this could be a fairly inexpensive way of getting those pixels. I thought we had discussed this previously, so maybe I am just not reading the claims well, but it doesn't seem like they are reaching for something this generalized and yet I don't see any reason why it shouldn't be as general as possible.

-doug
--
==========

Douglas J. DeAngelis
ddean@finishlynx.com
781-935-6959 781-938-0580 fax
800-989-LYNX

Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801
http://www.finishlynx.com

==========

CC: epkrantz@finishlynx.com; Ralph A. Loren; Vikki Harris

From: Eric P Krantz <epkrantz@finishlynx.com>
To: "David J. Rikkers" <djr@lahive.com>, <ddean@finishlynx.com>
Date: 6/21/03 9:55PM
Subject: Re: Draft Application (Our ref.: LSR-013)

Dave,

At 05:18 PM 6/18/03 -0400, you wrote:
>Re: Updated Draft Utility Patent Application
>"Method and Apparatus to Effectively Reduce
>a Non-Active Detection Gap of an Optical Sensor"

> In our final review of the application, we raised the question
>of whether the invention can also be implemented by the use of an
>optical collector other than an optical fiber to provide the gap
>reduction. For example, could a quartz or other optical collector be
>oriented toward a field of view and providing a gap reduction. In such
>a case, optical fibers could then be used between the optical collector
>and an optical sensor. Please let us know if we should modify the
>application to incorporate this concept.

The scale that we are presently concerned with, i.e on the order of 10 microns and less,
essentially describes a "coherent fiber" optical collection system for high resolution
imaging. Fiber optics are today typically described as both solid core and hollow core
structures that, by means of an index of refraction difference, operate on the principle
of total internal reflection (TIR).

OK

I believe that any elemental optical collector at this scale that operates on TIR can
be reasonably construed as a fiber optic analogue.

However, I can imagine in the world of nanotechnology fabrication that a single optical
element, part of an array, could be more closely construed as a "lens": that is, operating
without TIR primarily on the principle of refraction or diffraction.

in nano., could use a lens

If such an array were to be oriented towards a field of view, such that it performed the
similar function of the invention, or if it were to perform a primary or intermediary function
in conjunction with the optical fibers, it may be worth some mention. Indeed, refer to the prior
art on page 1 of the Margolin patent (No.4,748,680) on color document scanner as an
example of a refractive lens optical collector in this context.

Yet, at this time my instincts would be to go with what we have, with the following minor correction,
rather than broaden the scope to a more general filing and potentially weaker defense.

The amendment I propose may perhaps help mitigate the issue of other "non-fiber" collectors in the system:

ok

replace instances of "mounted to" for fiber ends at the sensor device side to "oriented to."

Thus, this does not limit us to a closed end system, and therefore addresses the open end

potential at either side of the fiber optic collection system.

The fiber optic remains the key #delivery system# of the method.

If you believe that the filing is well protected in the case of fiber optics as a #necessary# or #essential# or #integral# component of the "Method and Apparatus to Effectively Reduce a Non-Active Detection Gap of an Optical Sensor" then I would be satisfied (with the slightest bit of trepidation!) that:

>...the application sufficiently describes the invention to enable one of >ordinary skill in the art to make and use the invention without undue >experimentation.

I will be out of contact from Monday-Wednesday 23-25 June.

I look forward to your reply.

Sincerely,
Eric

==========

Dr. Eric P. Krantz
epkrantz@finishlynx.com
Home office: (607) 273-2967

Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801
781-938-0580 fax
http://www.finishlynx.com

==========

CC: "Ralph A. Loren" <ral@lahive.com>, "Vikki Harris" <vlh@lahive.com>

From: Eric P Krantz <epkrantz@finishlynx.com>
To: Doug DeAngelis <ddean@finishlynx.com>, "David J. Rikkers" <djr@lahive.com>
Date: 8/6/03 10:41AM
Subject: Re: Fwd: Re: Draft Application (Our ref.: LSR-013)

Dave and Ralph,
If you believe that the filing is at least not weakened by my recommendation
then let's do it.

Summary of changes I suggested are as follows:

>Yet, at this time my instincts would be to go with what we have,
>with the following minor correction, rather than broaden the scope
>to a more general filing and potentially weaker defense.
>The amendment I propose may perhaps help mitigate the issue of other
>"non-fiber" collectors in the system:

>replace instances of "mounted to" for fiber ends at the
>sensor device side to "oriented to."
>Thus, this does not limit us to a closed end system,
>and therefore addresses the open end
>potential at either side of the fiber optic collection system.
****
>The fiber optic remains the key and defensible
>*delivery system* of the method through which all other solutions
>must pass.
****

At 01:30 PM 8/3/03 -0400, Doug DeAngelis wrote:

>Since Eric was the one with the concerns, only he can tell us whether
>the application in its current form is the "best known mode".
>
>-doug

==========

Dr. Eric P. Krantz
epkrantz@finishlynx.com
Home office: (607) 273-2967

Lynx System Developers, Inc.
175-N New Boston Street
Woburn, MA 01801
781-938-0580 fax
http://www.finishlynx.com

==========

CC: "Ralph A. Loren" <ral@lahive.com>, Vikki Harris <vlh@lahive.com>

From: David J. Rikkers
To: Douglas J. DeAngelis; Eric P. Krantz
Date: 9/24/03 11:07AM
Subject: Final Draft Application (Our ref.: LSR-013)

Re: Updated Draft Utility Patent Application
"Method and Apparatus to Effectively Reduce
a Non-Active Detection Gap of an Optical Sensor"
Our Reference: LSR-013

Dear Eric and Doug:

An updated final draft of the patent application is attached in two files. The first file contains the text of the specification, while the second file contains the drawings. A redlined version, created by the Compare Documents feature of MS Word for illustrating changes in the text from the previous version, is also attached.

Please read the attached application to verify that it completely and accurately describes your invention and the best known mode for practicing the invention. Also, please verify that the application sufficiently describes the invention to enable one of ordinary skill in the art to make and use the invention without undue experimentation. If all is in order, you may proceed to execute the attached Declaration, preferably in blue ink. If any changes at all appear necessary then do not sign this document, but call me. This is because the patent laws do not permit changes to the text once the application is signed. We understand that both of you are inventors of the claimed invention and have prepared the Declaration accordingly. We also attach an Assignment for your signature, assigning your rights in the invention to Lynx System Developers, Inc. Please return the executed documents to us for filing.

Sincerely,
LAHIVE & COCKFIELD, LLP

David J. Rikkers, Esq.
Lahive & Cockfield, LLP
28 State Street
Boston, MA 02109
djr@lahive.com
617-994-0788 direct dial
617-227-7400
617-742-4214 fax

CC: Ralph A. Loren; Vikki Harris